THE MORTALITY AND FERTILITY OF FARMERS AND PASTORALISTS IN CENTRAL MALI 1950-1981

Allan G Hill
Sara C Randall
Oriel Sullivan

Centre for Population Studies

London School of Hygiene and Tropical Medicine

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Centre for Population Studies
London School of Hygiene and Tropical Medicine
University of London
Keppel Street, London WC1E 7HT, England

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Rokia Dembelé, Dramane Diarra, Mah Diarra, Felicité Diassana, Ami Dolo, Sidi Mohamed Gakou, Boubakar Kané, Rose Kinaté.

Twareg survey

Aboubacrine ag Mohammedoun, Kangou Niang, Mariama walet Hamay, Meti ag Mohamed Rhissa, Mohamed Assaleh ag Mohamed, Mohamed ag Mohamed Ali, Zeinabou walet Haletini.

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RESUME

Dans ce rapport, nous présentons un résumé des résultats obtenu de deux enquêtes démographiques, qui constituent une section d'un programme de recherche mis sur pied par le CIPEA et l'Université de Londres, dans le Delta intérieur du Mali. Ces recherches ont pour but général de découvrir des relations entre le genre de vie des cultivateurs et les éléveurs, et leur santé, leur niveau de nutrition et le taux de croissance naturel des populations animales et humaines. Le travail sur le terrain pur les deux premiéres études démographiques, chez les Bambara (cultivateurs du mil) et les Touaregs (éléveurs), a été effectué entre le début mars jusqu'à la fin de juillet 1981.

Puisque pour les populations du delta il manque un système complet de régistration d'état civil, pour établir les taux de mortalité et de fécondité parmi ces populations, il faut faire plusieurs études speciales. Nous avons choisi le système des enquêtes utilisant les questions indirectes et les méthodes d'estimation élaborées par le Professeur William Brass de l'Université de Londres. Il existe d'autres méthodes, mais nous croyons que parmi une population nomade, le système le plus facile pour le travail sur le terrain est constitué par les enquêtes à un seul passage.

Pour les résultats sommaires des deux enquêtes faites parmi les Bambaras et les Touaregs, les intéressés peuvent se référer aux tableaux 1-17 dans le texte. Dans la cinquième partie du rapport sont presentés quelques résultats comparables venant de deux études du Service de Coöperation de l'INSEE; l'une de la Mission Socio-économique du Soudan (1956-58) pour le Delta Central du Mali, l'autre pour le Mali entier 1960-61. Les chiffres ré-éstimés çi-dessous correspondent en général aux résultats de nos deux enquêtes de 1981, et ils indiquent la constance des taux démographiques des trois dernières décades.

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INTRODUCTION

For most of the Francophone countries of West Africa, the series of demographic surveys carried out in the colonial period or with French technical assistance in the late 1950s and early 1960s remained the most reliable and comprehensive source of information on fertility and mortality in the region until the 1970s. Recently, some new censuses and surveys have produced data which are broadly comparable with the original results. In the intervening period, some methodological developments have taken place which allow us to look at the original material in new ways.

Here, we report on the results from two sample demographic surveys carried out in Mali by a team from the Centre for Population Studies of the London School of Hygiene and Tropical Medicine in conjunction with the International Livestock Centre for Africa. The data are for two ethnic groups - a settled village population of Bambara millet farmers and a group of Twareg nomadic cattle herders - both of whom live in or around the inner delta of the river Niger in central Mali. Field-work for the Bambara survey took place in March-May 1981 and for the Twareg sample, in May-July 1981. A third survey amongst the Fulani (Fulbé or Peul) was completed in February-April 1982 and an extension to the original Twareg survey took place in April-May 1982. So far, these latter data have not been analysed. The survey results for the Bambara and Twareg are summarized and then compared with the older material from the Mission Socio-économique 1956-58 and a demographic survey carried out by the new Republic of Mali in 1960-61. Some comparisons are also drawn with the census results from December 1976.

1. THE BAMBARA AND TWAREG SURVEYS 1981

The main aim of all three single round retrospective demographic surveys undertaken amongst samples of the Bambara, Twareg and Fulani ethnic groups in Mali was to produce comparable estimates of the basic demographic parameters for each population. As far as possible, the surveys were focused in the same geographical region, the central or inner "delta" of the river Niger. The "delta" is in fact a flat, marshy zone which floods in the rainy season (July-October) where the rivers Niger, Diaka, and Bani separate and rejoin. The delta extends roughly from Ké-Macina in the southwest to Lake Débo in the north, an area of approximately 18,000 km² (Figure 1). Within this large and varied ecological zone, each ethnic group to this day retains its quite distinctive way of life, culture and language. Virtually every ethnic group has some connection with livestock and pasturage but the degree of dependence varies from slight (the Bambara are settled millet farmers) to total (the fully nomadic pastoral Twareg). Although the Twareg population for whom data are presented here are not typical of Sahelian nomads because of their reliance on the delta's flood waters and marshes, for at least part of the year most of the Twareg interviewed spend some time in the surrounding semi-arid zone. At a later date, some results will be available for both Twareg and Fulani groups who spend all their lives outside the delta in the Sahel of Mali.

The surveys themselves consisted of two interviews: a census-type questionnaire addressed to each household head requesting information on the household members; and an interview for all women of reproductive age consisting very largely of a complete birth history. The household questionnaire included the Brass questions on children everborn, surviving children, and births in the preceding 12 months for all women, together with questions on widowhood and orphanhood for adults. In the women's interview, some "current status" questions were asked to ascertain the mean length of breast feeding, post-partum amenorrhoea and periods of spousal separation. The unit of enumeration was the "household" but in fact this concept was not immediately applicable to the survey populations. For the Bambara, the locally recognized residential unit is the Gwa, a small lineage or extended family, each with a Gwa-tigi, or a chief. Amongst the Twareg, since families were so split up by migration, the unit used for the survey was the tent, each with a chief. No attempt was made to link "free" Twareg with the dependent Bella unless the Bella were found sleeping in the same tent as their masters. As far as possible, the two interiews were conducted independently of each other although the results from each were used for cross-checking and verification. All the questions were posed in Bambara or Tamasheq by native speakers using a French text for reference. Male interviewers first contacted the household heads and interviewed them, identified women eligible for interview and the female interviewers completed the individual interview with each woman.

Figure 1. Location map showing the Niger Delta of central Mali.
Scale : 1/1,000,000. The grid squares are 108 km.

Table 1

POPULATION SIZE AND COMPOSITION OF THE SAMPLES

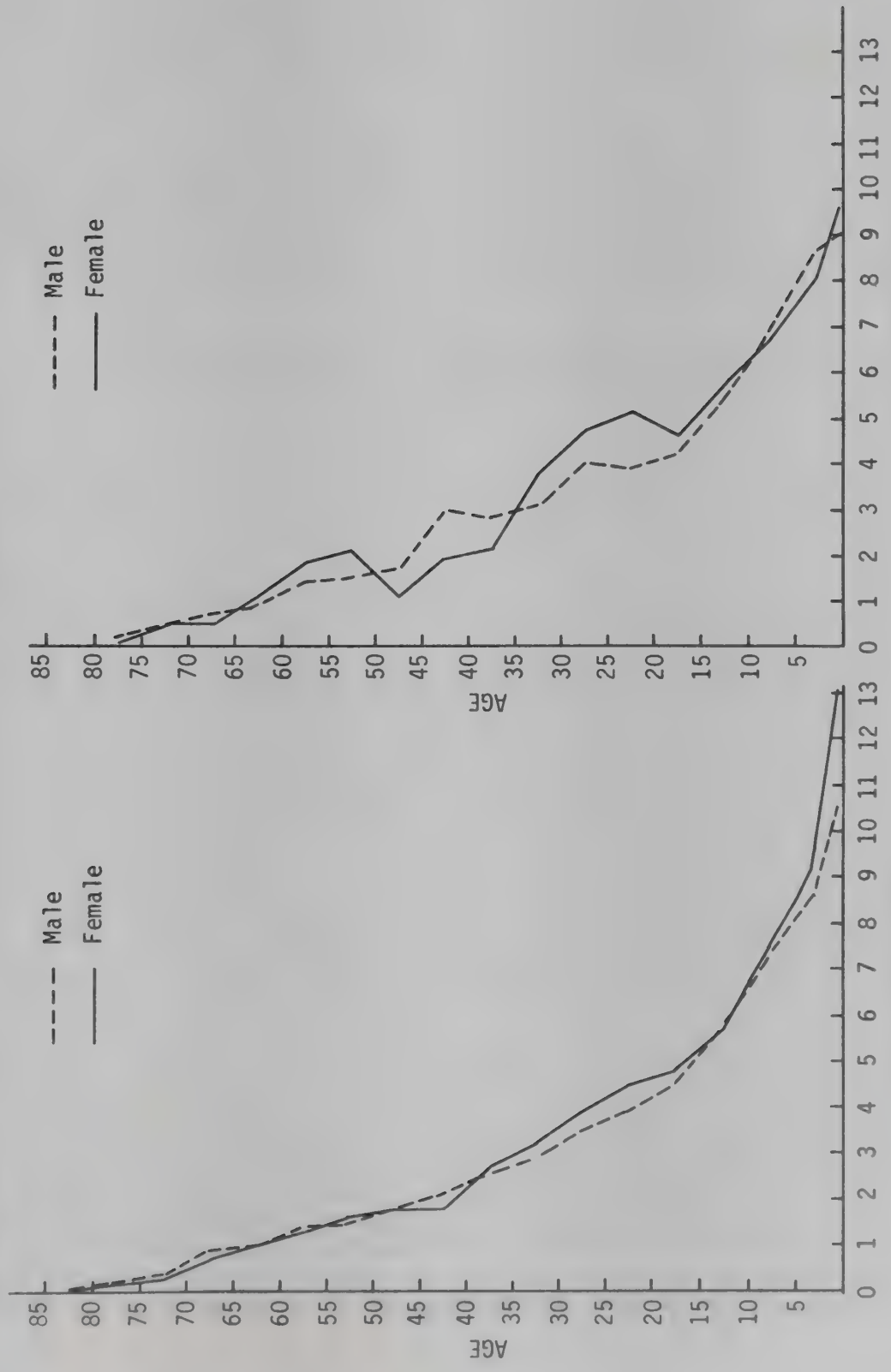
BAMBARA

	DOURA	MONNIMPÉ	TOTAL
Total enumerated	6,897	3,259	10,156
Males	3,413	1,560	4,973
Females	3,484	1,699	5,183
Women 15-50 interviewed	1,249	566	1,815

TWAREG

	FREE TWAREG	BELLA	TOTAL
Total enumerated	3,251	2,867	6,118
Males	1,678	1,344	3,022
Females	1,573	1,523	3,096
Women 15-50 interviewed	712	577	1,289

Figure 2. Age - sex distributions



In the Bambara survey conducted in 50 villages varying in size from 16 to 1678 inhabitants, 10,156 people were enumerated, 6897 in the relatively impoverished "Sahelian" arrondissement of Doura near Niono, and 3259 in the better-off arrondissement of Monnimpé close to the river Niger near Markala. In all, 1815 women's interviews were successfully completed. The delta Twareg proved harder to locate and enumerate but all 6118 were counted in 96 camps and 1289 women's interviews were completed. (Table 1). In May-July 1981, the camps were spread throughout the northern part of the Niger delta from just west of Mopti to well outside the delta itself in the semi-arid zone to the north of Léré and Soumpi (Figure 1). Results are presented for the two different arrondissements in which the Bambara were enumerated and for two Twareg social classes. Although the political and social divisions in Twareg society are very complex, for analysis it did seem worthwhile to separate the racially distinct "free" Twareg from the much blacker Bella servants or ex-slaves.

2. AGE AND SEX COMPOSITION OF THE POPULATIONS SURVEYED

The age-sex distribution for the two groups are shown in Figure 2. These are rather uneven, especially the Twareg. The irregularities reflect some major age misreporting, which is hardly surprising in populations where the literacy level is 9.3 per cent for the Bambara (Quranic and government schools combined) and 0.5 per cent for the Twareg (government schools), and 10.8 per cent (Quranic schools). The Twareg are also very isolated from major national and international events and thus ageing by reference to these is impossible. In general, the age distributions have the broad bases characteristic of rapidly growing populations. When sub-divided (Doura/Monnimpé) the Bambara Monnimpé distribution, with 50.4 per cent of the population under age 15, is even younger than that for all Bambara. Bambara female age misreporting produces a dearth of females aged 40-44 and a possibly concomitant surplus at the two adjacent age groups. From the current age-specific fertility data (Table 10) it seems probable that women who have recently had a birth were pushed down an age group, to be declared as in their 30's rather than their 40's. For this society, age 40 may be a threshold over which women are considered to be moving out of the 'mother' category into more of an old woman or grandmother category. Still fertile women may not be thought of as 'old' and are therefore moved to a 'young' age. This hypothesis is consistent with the very high reported age specific fertility rate for the 35-39 year olds (Figure 10a).

Age misreporting by Twareg women looks to be rather more serious than for the Bambara. The fact that women aged 51 plus did not have to be interviewed may account for the lack of 45-49 year olds! The surplus of younger women, the dearth of women in their late 30's and 40's and the surplus aged 50+ may be a reporting phenomenon whereby those in their 40's are moved up or down depending on whether they are still reproducing or not. This seems more likely than a massive change at about age 35 from a surplus of women to a surplus of men. The pattern is the same for the two regional sub-groups. There does not appear to be much out migration although it would be difficult to separate any minor effects introduced by migration from age misreporting.

3. MORTALITY

3a Methodology

Direct questions on child and adult deaths or even on recent births have been found to elicit poor responses in both modern and traditional societies. Much better reports on fertility and mortality experience in the pre-survey period can be obtained by asking indirectly about vital events - questions on the survival of parents (orphanhood), on first spouses (widowhood) or on the number of children everborn and surviving at the time of the survey. The drawback with these questions is that generally a variety of fertility and mortality models have to be used to produce life table measures of mortality or estimates of age-specific fertility from the responses. Recent developments in demography now allow the use of a greater variety of models and model relationships than ever before. This is not the place to discuss these developments at length, but a paragraph of explanation is necessary for the non-specialist reader to interpret the results presented below.

Every sizeable population has a characteristic age pattern of mortality which is generally unknown at the outset in the population under study. Several model life table systems exist including Brass's two and four parameter logit life tables with different standards, the old and new UN model life tables, the OECD tables for developing countries and the Princeton series prepared by Coale and Demeny (1966). For simplicity, the widely used Princeton series is used here for estimates of mortality: two age patterns are of interest to us - the so-called "West" or developed country average pattern, and the "South" pattern in which, at any specified level of adult mortality, infant and childhood mortality is higher than in the West series of life tables. The Princeton model life tables are presented as 24 levels numbered from 1 to 24, each level representing an increment of 2.5 years on the female expectancy of life at birth. Level 1 has a female expectancy of life at birth ($\mathring{e}_0$) of 20.0 years, and level 24 an $\mathring{e}_0$ = 77.5 years. The advantage of using these tables and assuming an age pattern from one of the models is that any information on a part of the life table can be used to estimate other sections of the life table or even a whole model life table. This is the way, for example, infant mortality and then trends in infant mortality (attaching dates to the estimates), can be measured from the retrospective data on the proportions dead of children everborn to women in 5-year age groups at the time of survey.

In a final technical note, the demographic reader will want to know that the regression form of Brass's childhood mortality procedure (Trussell's equations) was used throughout to estimate infant and child mortality. Adult mortality was estimated using the Brass weights giving conditional rather than unconditional adult survivorship measures since we wanted to make separate adult and child mortality estimates before linking these in a model life table. The time location of the child mortality measures also use Trussell's estimation

equations but for adult mortality, the time location of the estimates were derived using a new and largely untried method developed by Brass and Bamgboye (1981).

3b Child mortality

Mortality was estimated for both adults and children using indirect techniques. No data were collected on deaths in the year preceding the survey because the sample was too small to permit analysis of these data, and it was felt that other indirect techniques of estimating mortality would provide better measures.

Estimates of infant and child mortality were made using proportions dead of children everborn, and the Trussell regression equations. Originally, both Bambara and Twareg mortality estimations were made using the Coale and Demeny West model life tables. However, for the Bambara, there were large discrepancie between the child and adult mortality levels, with child much heavier than adult mortality in relation to the West model, so South models were used for this group, giving much more consistent results. Hence, in all the results presented below, South mortality models are used for the Bambara and West for the Twareg.

Tables 2 and 3 show the estimated q_x values (where q_1 is the probability of dying from 0 to exact age 1, q_2 the probability of dying between 0 and exact age 2 etc) for the Bambara from the two data sets, and for each arrondissement. These are equivalent to a South model life table level from which $1000._5q_0$ is obtained. Figure 3 shows the time trend of the South model life table levels (increasing level implies decreasing mortality). If we exclude the estimates obtained from women aged 15-19 which often give unreliable results, we find that Bambara infant and child mortality has not changed since the mid-1960's, an almost constant level of mortality around South level 7 in the Princeton model life tables. This is equivalent to an infant mortality rate of about 200 per thousand and a child mortality rate (from birth to age 5) of 360 per thousand.

Estimates from the Bambara household data indicate no difference between male and female child mortality nor is there any difference by arrondissement. Similar estimates of mortality obtained from the independent birth history data give the same overall level of mortality and an identical lack of improvement over time. The birth history data do indicate slightly better levels of mortality for Monnimpé than Doura, the mean estimated $_5q_0$ for the former being .330 and for the latter .384.

Twareg infant and child mortality (Tables 4 and 5) may have improved slightly over the last 15 years according to the birth history data, although not from the household data (Figure 4). Again, we exclude the estimate from the 15-19 year old women. The mean estimated child mortality from birth to age 5 is 307 per thousand and infant mortality is 198 per thousand (from the household data). There is little difference in the mortality levels estimated from the birth history and the household data. As the two data sets were collected

Table 2

BAMBARA INFANT AND CHILD MORTALITY (household data)
(estimated using Trussell regression and South model life tables)

Age of Mother	x	Propn's dead of CEB	q_x	$1000._5q_0$	South model level	Years prior to survey
15-19	1	.126	.133	213	13.53	.9
20-24	2	.281	.289	361	7.28	2.3
25-29	3	.323	.320	352	7.61	4.4
30-34	5	.337	.380	380	6.59	7.0
35-39	10	.378	.386	357	7.41	9.8
40-44	15	.407	.407	363	7.19	12.8
45-49	20	.442	.437	371	6.89	16.0

b) Doura

Age of Mother	x	Propn's dead of CEB	q_x	$1000._5q_0$	South model level	Years prior to survey
15-19	1	.127	.135	218	13.30	.9
20-24	2	.277	.284	354	7.51	2.3
25-29	3	.332	.328	360	7.29	4.5
30-34	5	.373	.371	371	6.91	7.1
35-39	10	.374	.380	351	7.64	10.0
40-44	15	.421	.419	374	6.79	13.1
45-49	20	.468	.461	392	6.14	16.2

c) Monnimpé

Age of Mother	x	Propn's dead of CEB	q_x	$1000._5q_0$	South model level	Years prior to survey
15-19	1	.125	.131	209	13.75	.9
20-24	2	.288	.295	368	6.99	2.3
25129	3	.311	.308	338	8.14	4.4
30-34	5	.396	.395	395	6.03	7.0
35-39	10	.389	.396	367	7.05	9.8
40-44	15	.377	.377	336	8.21	12.9
45-49	20	.389	.385	325	8.63	16.0

Notes: CEB = children ever born. q_x is the life table probability of dying between birth and exact age x.

Table 3

BAMBARA INFANT AND CHILD MORTALITY (birth history)
(estimated using Trussell regression and South model life tables)

a) All Bambara

Age of Mother	x	Propn's dead of CEB	q_x	$1000._5q_0$	South model level	Years prior to survey
15-19	1	.170	.183	320	8.84	.8
20-24	2	.298	.301	376	6.73	2.3
25-29	3	.344	.333	366	7.07	4.6
30-34	5	.377	.369	370	6.95	7.4
35-39	10	.402	.402	372	6.87	10.6
40-44	15	.410	.403	359	7.35	13.8
45-49	20	.434	.422	358	7.37	17.0

b) Doura

Age of Mother	x	Propn's dead of CEB	q_x	$1000._5q_0$	South model level	Years prior to survey
15-19	1	.147	.169	292	10.00	.7
20-24	2	.318	.331	414	5.41	2.1
25-29	3	.346	.340	373	6.81	4.4
30-34	5	.381	.375	375	6.75	7.2
35-39	10	.415	.416	385	6.40	10.3
40-44	15	.439	.432	386	6.37	13.6
45-49	20	.460	.449	382	6.52	16.8

c) Monnimpé

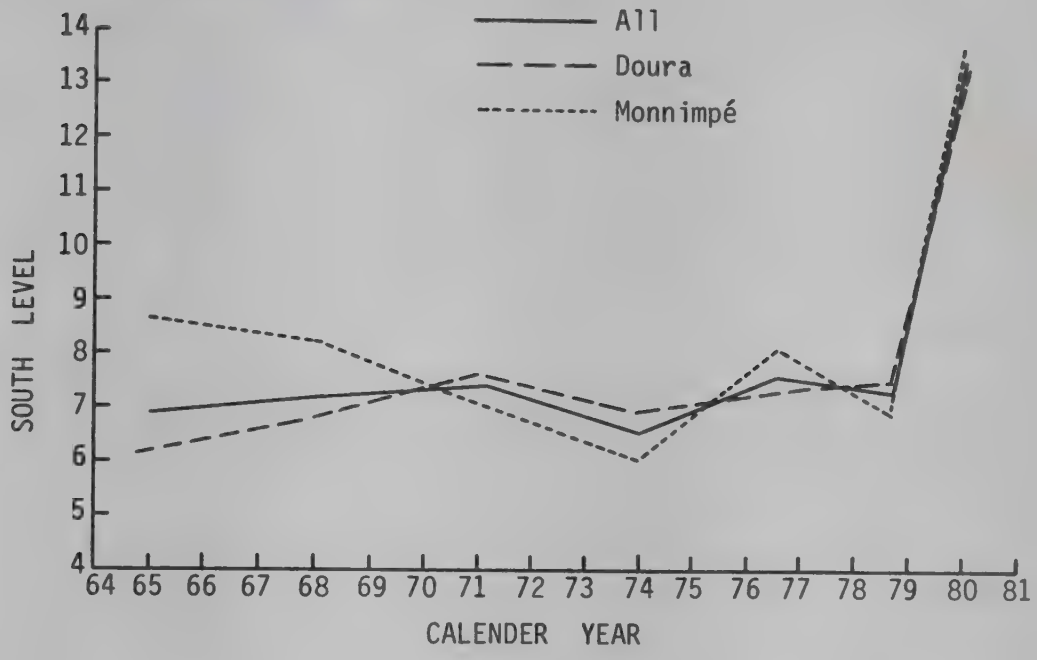
Age of Mother	x	Propn's dead of CEB	q_x	$1000._5q_0$	South model level	Years prior to survey
15-19	1	.192	.180	313	9.13	1.1
20-24	2	.269	.258	320	8.83	2.7
25-29	3	.339	.323	355	7.50	5.0
30-34	5	.371	.361	361	7.26	7.8
35-39	10	.365	.365	337	8.17	10.9
40-44	15	.366	.359	320	8.85	14.0
45-49	20	.357	.347	293	9.96	17.1

Notes: CEB = children ever born. q_x is the life table probability of dying between birth and exact age x.

Figure 3.

Bambara infant and child mortality (using south models)

(a) Bambara household



(b) Bambara birth history data

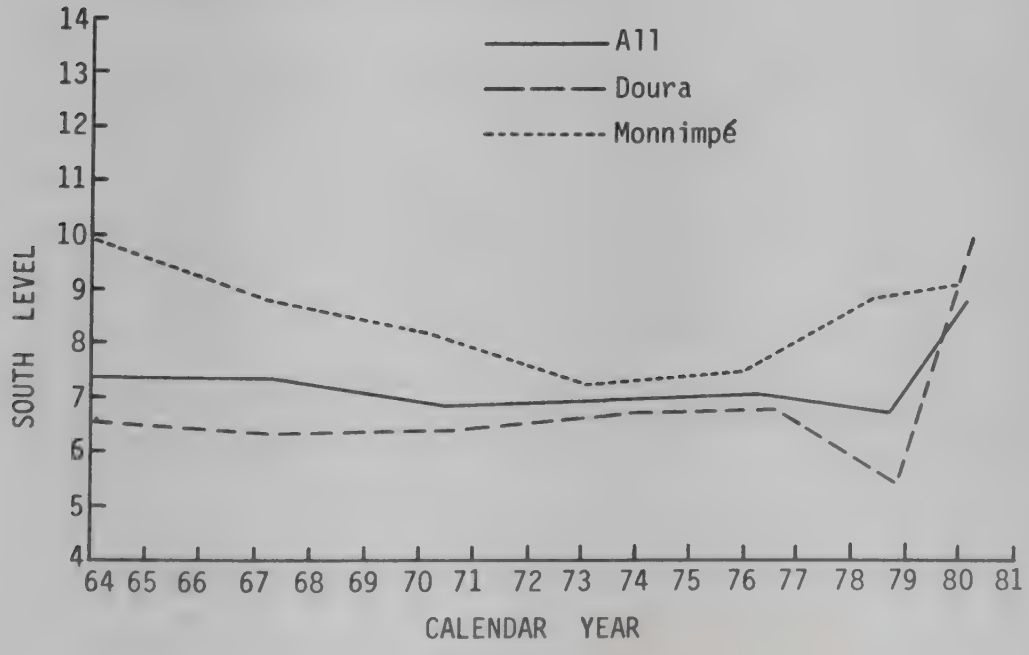


Table 4

TWAREG INFANT & CHILD MORTALITY (Household data)
(estimated using Trussell regression and West model life tables)

a) All Twareg

Age of Mother	x	Propn's dead of CEB	q_x	$1000._5q_0$	South model level	Years prio to survey
15-19	1	.232	.237	351	6.75	1.1
20-24	2	.216	.219	262	10.04	2.5
25-29	3	.254	.249	272	9.62	4.6
30-34	5	.337	.335	335	7.30	7.0
35-39	10	.338	.342	317	7.93	9.6
40-44	15	.385	.386	341	7.10	12.3
45-49	20	.386	.384	317	7.94	15.2

b) "Free" Twareg

Age of Mother	x	Propn's dead of CEB	q_x	$1000._5q_0$	South model level	Years prio to survey
15-19	1	.276	.285	416	4.66	1.1
20-24	2	.251	.259	309	8.23	2.4
25-29	3	.289	.287	313	8.06	4.4
30-34	5	.365	.367	367	6.20	6.6
35-39	10	.379	.388	361	6.40	9.2
40-44	15	.438	.443	394	5.33	11.8
45-49	20	.383	.385	318	7.90	14.8

c) Bella & blacksmiths

Age of Mother	x	Propn's dead of CEB	q_x	$1000._5q_0$	South model level	Years prio to survey
15-19	1	.200	.201	300	8.57	1.1
20-24	2	.189	.189	226	11.53	2.6
25-29	3	.225	.218	239	10.99	4.7
30-34	5	.301	.296	296	8.70	7.2
35-39	10	.290	.292	269	9.74	9.9
40-44	15	.304	.302	264	9.96	12.7
45-49	20	.391	.385	318	7.89	15.6

Notes: CEB = children ever born. q_x is the life table probability of dying between birth and exact age x.

Table 5

TWAREG INFANT & CHILD MORTALITY (Birth history data)
(estimated using Trussell regression and West model life tables)

a) All Twareg

Age of Mother	x	Propn's dead of CEB	q_x	$1000._5q_0$	South model level	Years prior to survey
15-19	1	.189	.205	305	8.37	1.0
20-24	2	.181	.186	222	11.70	2.4
25-29	3	.234	.229	251	10.50	4.5
30-34	5	.296	.293	293	8.83	7.0
35-39	10	.318	.320	296	8.70	9.7
40-44	15	.391	.389	344	6.99	12.6
45-49	20	.387	.384	317	7.94	15.5

b) "Free" Twareg

Age of Mother	x	Propn's dead of CEB	q_x	$1000._5q_0$	South model level	Years prior to survey
15-19	1	.207	.223	331	7.42	1.0
20-24	2	.183	.186	222	11.69	2.4
25-29	3	.279	.271	296	8.69	4.6
30-34	5	.315	.310	310	8.19	7.2
35-39	10	.358	.359	333	7.37	10.0
40-44	15	.447	.442	393	5.36	12.9
45-49	20	.389	.382	315	8.00	15.8

c) Bella & blacksmiths

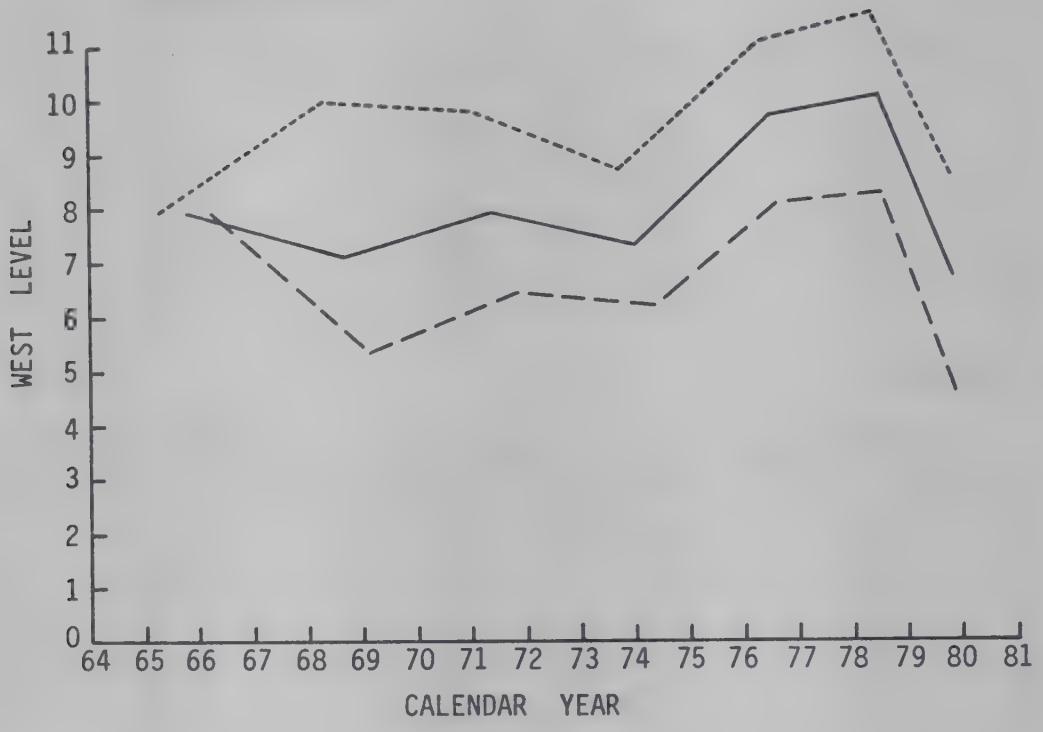
Age of Mother	x	Propn's dead of CEB	q_x	$1000._5q_0$	South model level	Years prior to survey
15-19	1	.167	.184	275	9.53	1.0
20-24	2	.179	.185	221	11.76	2.4
25-29	3	.202	.197	216	11.96	4.5
30-34	5	.271	.268	268	9.79	7.0
35-39	10	.260	.259	239	10.97	9.8
40-44	15	.299	.297	259	10.14	12.7
45-49	20	.388	.382	315	7.99	15.6

Notes: CEB = children ever born. q_x is the life table probability of dying between birth and exact age x.

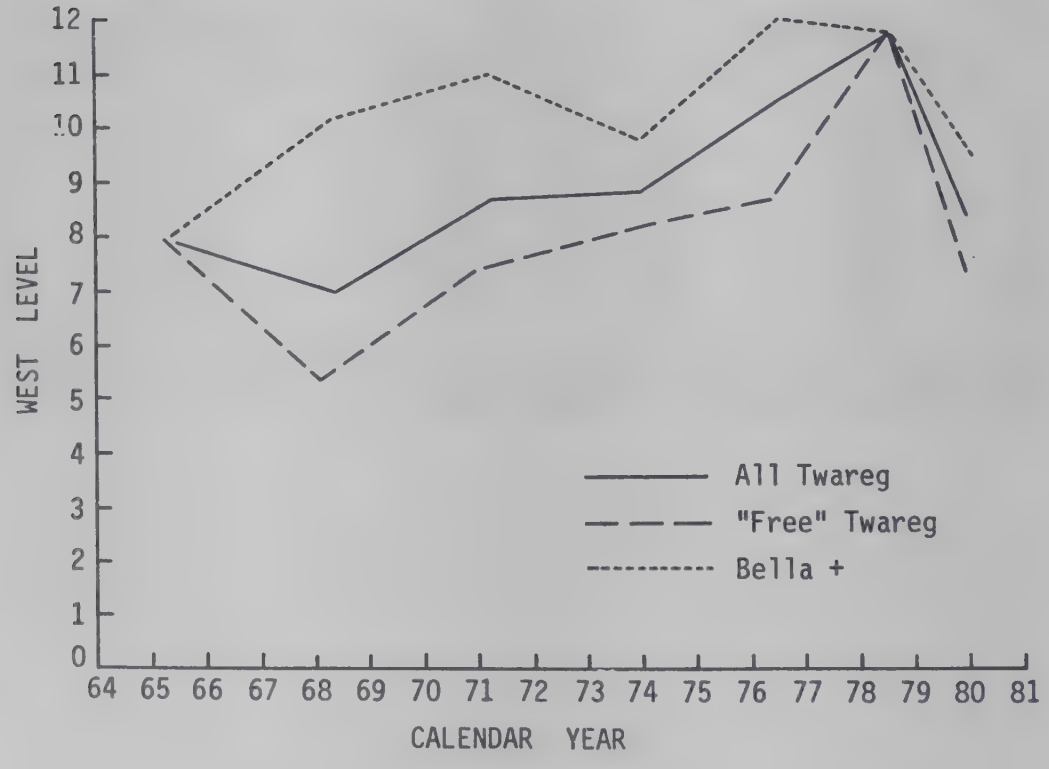
Figure 4.

Twareg infant and child mortality (using west models)

(a) Household data



(b) Birth history data



as independently as possible, it is gratifying to note these similarities in a population in which age misreporting and omissions are common.

The most interesting feature of Twareg child mortality is the quite substantial difference between the "free" Twareg and the Bella. This difference is reflected in both data sets (household and individual) giving a mean childhood mortality rate of 342 per 1,000 for the "free" Twareg and 268 per 1,000 for the Bella from the household data; and 309 per 1,000 for the "free" Twareg and 252 per 1,000 for the Bella from the birth history data. The difference in mortality between the two subgroups is clearly a real one, and has been present for some time, as the time references of the estimates offer no evidence that the difference has only recently emerged.

3c Adult mortality

Adult mortality was estimated using the Brass orphanhood techniques from proportions orphaned by age, and the mortality of each group and sub-group was compared over time using the recently developed time location equations (Brass and Bamgboye, 1981). All the results presented give the conditional survivorship and model life table levels from a base of 1_{25} for women and $1_{32.5}$, $1_{37.5}$ or 1_{40} for men. Any differences in child mortality between the groups thus have no bearing on these adult mortality results.

Table 6 gives the estimated conditional probabilities of Bambara adult female survival from age 25 to age 25 + N, the South model life table level and the time location of the estimates. From Figure 5 we see that Bambara adult female mortality appears to have been improving substantially over the last 15 years. However, the very steep slope of the graph indicates an increase in $\mathring{e}_o$ from 35 to 47.5 in 10 years which is highly improbable, especially since child mortality has not changed at all over the same period. If changes are occurring and mortality is falling in a population with high mortality, generally it is infant and child mortality that falls first, as the causes of death in these young groups (such as tetanus and diarrhoeal diseases) are easier to eliminate. Thus for adult mortality to fall this much we must look for some very sound and specific reasons or else suspect the data. A similar rapid mortality change is also indicated for the Bambara men. (see Figure 6 and Table 7).

Apart from the time trend, the obvious important feature emerging from these estimates is the definite difference in mortality between the two arrondissements with Monnimpé about 5 levels higher than Doura (12.5 years higher expectation of life) for women and about 4 levels higher for men since the early 1970's. These differences remain more or less constant over time despite the apparent decrease in mortality discussed above.

Twareg adult female mortality shows an even greater apparent improvement over time than the Bambara (see Table 8 and Figure 7) but male adult mortality indicates a more gradual improvement (Table 9, Figure 8). Again, some recent improvements in mortality might be indicated, but reporting problems are a more

Table 6

BAMBARA FEMALE ADULT MORTALITY - using orphanhood, the Brass method & South model life tables

a) All Bambara

N	$_{25+N}1_{25}$	t	South level
10	.943	4.26	12.48
15	.897	6.29	11.07
20	.844	8.22	9.94
25	.791	9.99	9.33
30	.732	11.57	9.12
35	.603	13.45	6.78
40	.526	14.66	7.91
45	.376	*	7.34
50	.247	*	8.08
55	.162	*	10.59

b) Doura

N	$_{25+N}1_{25}$	t	South level
10	.930	4.24	10.73
15	.881	6.26	9.69
20	.825	8.19	8.63
25	.763	10.01	7.75
30	.705	11.61	7.83
35	.570	13.60	5.54
40	.486	15.01	6.52
45	.380	*	7.49
50	.214	*	6.82
55	.172	*	11.10

c) Monnimpé

N	$_{25+N}1_{25}$	t	South level
10	.969	4.28	16.75
15	.935	6.31	14.95
20	.899	8.18	14.03
25	.863	9.84	13.76
30	.796	11.40	12.45
35	.683	13.00	10.03
40	.625	13.86	11.65
45	.391	16.53	7.85
50	.310	*	10.39
55	.145	*	9.68

Notes: t = years before the survey
* = not calculated

Figure 5.

Bambara adult female mortality

(using South models and conditional survivorship)

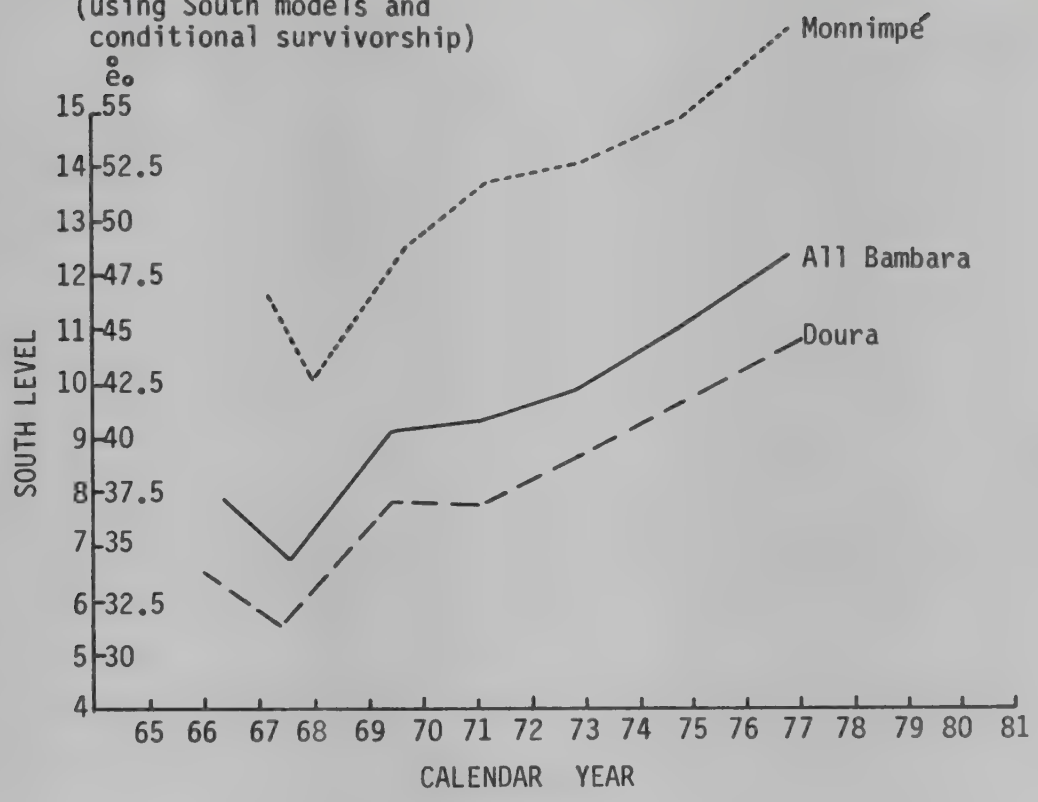


Figure 6.

Bambara adult male mortality

(using South models and conditional survivorship)

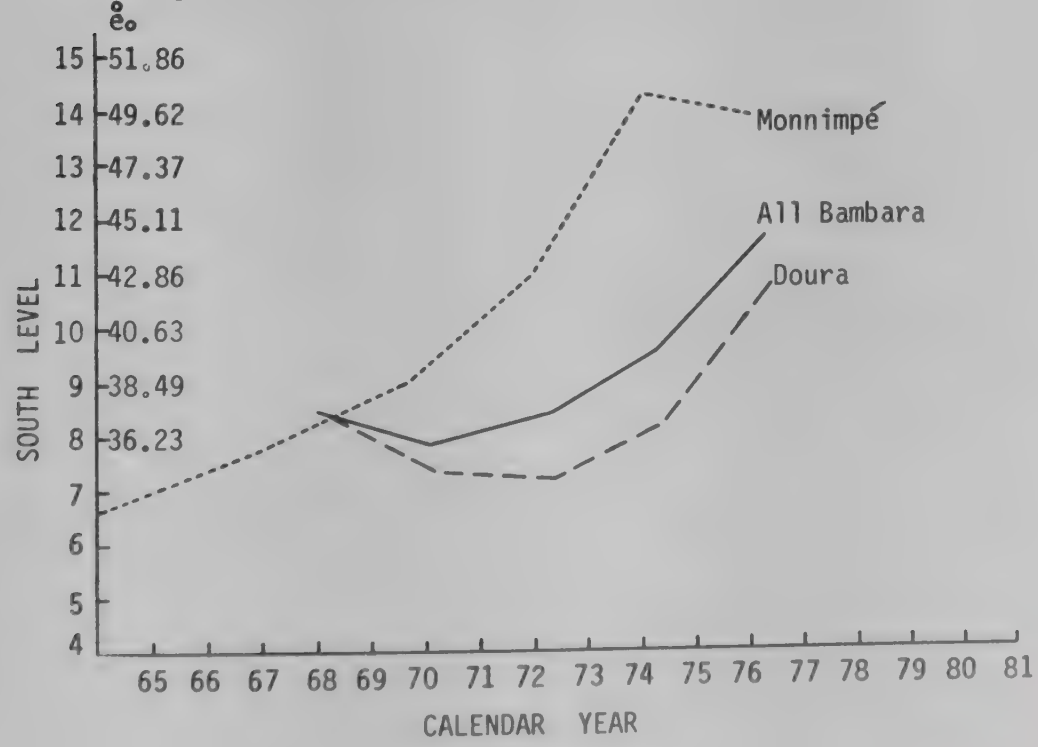


Table 7

BAMBARA MALE ADULT MORTALITY - using orphanhood, the Brass method & South model life tables

a) All Bambara

N	$1_{40+N}/1_{37.5}$	t	South level
10	.877	4.74	11.62
15	.780	6.73	9.52
20	.664	8.78	8.32
25	.529	10.91	7.80
30	.398	12.98	8.41
35	.218	*	7.17
40	.178	*	13.33
45	.034	*	*

b) Doura

N	$1_{40+N}/1_{40}$	t	South level
10	.869	4.62	10.74
15	.761	6.62	8.16
20	.643	8.67	7.20
25	.517	10.77	7.28
30	.396	12.72	8.36
35	.225	*	7.51
40	.202	*	14.84
45	.048	*	*

c) Monnimpé

N	$1_{40+N}/1_{40}$	t	South level
10	.897	5.00	13.91
15	.839	6.94	14.29
20	.708	9.09	10.93
25	.555	11.27	9.04
30	.386	13.76	7.87
35	.207	16.90	6.66
40	.097	*	7.44
45	.019	*	*

Notes: t = years before the survey
* = not calculated

Table 8

TWAREG FEMALE ADULT MORTALITY - using orphanhood, the Brass method & West model life tables

a) All Twareg

N	$_1P_{25+N} / {}_1P_{25}$	t	West level
10	.918	4.29	11.34
15	.883	6.31	12.20
20	.821	8.28	11.06
25	.738	10.22	9.57
30	.628	12.23	7.91
35	.483	14.58	5.82
40	.393	16.41	6.42
45	.262	*	5.72
50	.223	*	8.67
55	.083	*	6.58

b) "Free" Twareg

N	$_1P_{25+N} / {}_1P_{25}$	t	West level
10	.898	4.23	9.08
15	.867	6.20	10.91
20	.823	8.06	11.24
25	.712	10.09	8.36
30	.618	11.96	7.51
35	.446	14.65	4.60
40	.366	16.37	5.54
45	.216	*	4.05
50	.233	*	9.08
55	.057	*	4.59

c) Bella & blacksmiths

N	$_1P_{25+N} / {}_1P_{25}$	t	West level
10	.938	4.33	13.97
15	.898	6.40	13.58
20	.827	8.43	11.45
25	.773	10.26	11.26
30	.650	12.34	8.78
35	.538	14.28	7.74
40	.447	15.93	8.23
45	.330	17.77	8.16
50	.236	*	9.20
55	.127	*	9.38

Notes: t = years before the survey
* = not calculated

Figure 7.

Twareg adult female mortality

(using west models and conditional survivorship)

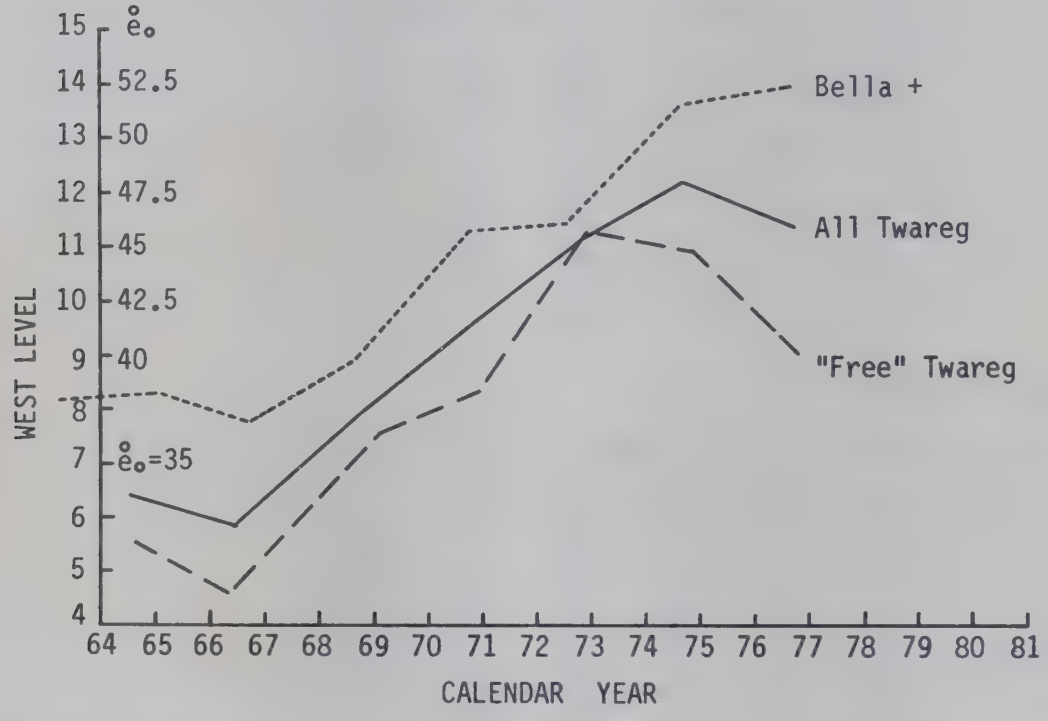


Figure 8.

Twareg male adult mortality

(using west models and conditional survivorship)

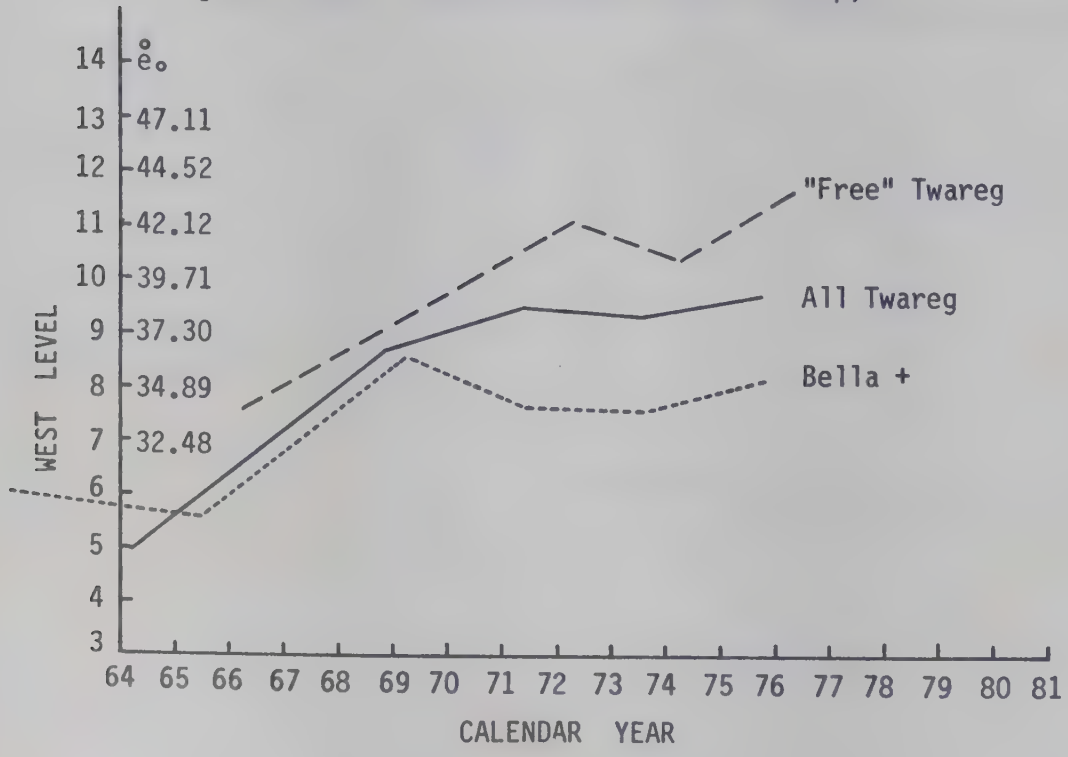


Table 9

TWAREG MALE ADULT MORTALITY - using orphanhood, the Brass method and West model life tables

a) All Twareg

N	$_1/_{40+N}1_{37.5}$	t	West level
10	.806	5.20	9.66
15	.700	7.43	9.29
20	.594	9.65	9.44
25	.447	12.27	8.66
30	.223	16.84	4.97
35	.164	18.70	7.25
40	.018	*	1.42

b) "Free" Twareg

N	$_1/_{40+N}1_{37.5}$	t	West level
10	.834	4.65	11.54
15	.722	6.68	10.31
20	.631	8.69	11.01
25	.470	11.12	9.53
30	.287	14.77	7.52
35	.142	*	6.15
40	.055	*	5.62

c) Bella & blacksmiths

N	$_1/_{35+N}1_{32.5}$	t	West level
10	.814	5.11	8.11
15	.715	7.33	7.57
20	.615	9.55	7.62
25	.533	11.79	8.52
30	.330	15.52	5.56
35	.233	18.00	6.20
40	.080	*	3.11
45	.119	*	11.23

Notes:
N = Central age of respondents
t = Years before the survey
* = not calculated

likely explanation. The method of estimation assumes that the proportion of surviving children does not vary with the survivorship of their parents. For paternal mortality this seems a reasonable assumption, but if maternal mortality is very high and linked to previous obstetric and gynaecological problems this assumption loses some validity.

A comparison between the two Twareg population sub-groups may be more profitable than attempts to understand trends and errors. Again, there are differences between them. Bella adult female mortality is, on average 2 model life table levels (a difference in $\mathring{e}_0$ of 5 years) better than that of "free" women but the reverse is true for men. The probable health advantages of Bella over "free" Twareg women are discussed later. Bella men are often away looking after the herds with less access to a fixed base than "free" Twareg and thus may be more prone to accidental death and dietary deficiencies. It is hoped that some labour, budget and nutritional research begun by the International Livestock Centre for Africa (ILCA) may be able to throw more light on these sex-class differences.

As mentioned earlier, all the Bambara mortality estimates used South model life tables, whereas for Twareg West were used. In the original estimates West models were used for both but the model life table levels obtained for Bambara adult and child mortality differed extensively from each other. Adult mortality estimates gave a mean e_0 for males of 46.5 years and for females 46.8 years, whereas child mortality levels had a means e_0 of 32.9. Obviously the age pattern of mortality in the population was very different to that of the West model. Twareg, with a mean adult male $\mathring{e}_0$ of 35.4 and a mean adult female $\mathring{e}_0$ of 40.1 years had a very similar level of child mortality giving an e_0 of 37.0 years. Thus the pattern of mortality in the two populations is very different. Bambara mortality is closer to the South model with much higher infant and child mortality compared to the adult levels.

From the above, we learn that the Bambara and the Twareg have very different levels and age patterns of mortality. Amongst the Bambara, child mortality is very high in absolute terms and relative to adult survivorship. Within the Bambara sample, differences in child mortality are small but for adults, mortality is lower in the less marginal arrondissement of Monnimpé. Child mortality differences are now more pronounced within the Twareg sample; Bella having the lower mortality. The mortality of Bella adult females also appears better than amongst the "free" Twareg.

3d Mortality levels - a discussion

For the Bambara there has probably been some recent improvement in adult mortality, possibly through the increased contact of younger adults with the towns and further afield during the dry season. In this slack season, many of the young adults go to Ségou, Bamako or even to Ivory Coast to earn money for both taxes and personal cash. Much of the reluctance to use medical and other facilities stems from distance, fear of the unknown and lack of money. For these young adults all three problems can be overcome. People do not stop migrating on marriage so that young adults may well have

improving mortality which will show in these estimates. It is, however, unlikely to be as rapid as the estimate would suggest. Adoption is widely practiced among the Bambara, and women re-marry quickly after the death of their husband. Failure to obtain data on the survival of true parents could also lead to a false impression of improvements.

The question then arises, why are there such big differences in adult mortality between Doura and Monnimpé when child mortality remains the same for both areas? Both areas have similar levels of dry season out-migration. The main differences between them are diet, apparent over-all wealth and availability of services. Monnimpé is less agriculturally marginal than Doura, and has a more assured crop success. Several Monnimpé villages said that even in the 1973-74 drought, they had a reasonable harvest and that recently, they have had a surplus. All the Doura villages said that since the drought, the rain has been so poor that they have been unable to sow sorghum, hence their crop and their diet has been largely millet. In Monnimpé some villages still grew some sorghum and we frequently saw people eating rice bought from outside the area. These people also had access to a larger variety of foods from a big market held weekly in Monnimpébougou which also has a school and a dispensary. Although itself not part of the sample area, Markala, with over 1,600 inhabitants, forming about half of the Monnimpé sample, is only 3km from Monnimpébougou and all its services. The demographic team remarked that people ate far more meat and a greater variety of foods here than in Doura. The varied diet and access to minimal medical services may well have affected adult morbidity and mortality more than child mortality, particularly if child care and attention is a major factor. Monnimpé women do no less work than Doura women, they have to pull water from equally deep wells, and the agriculture is equally time and energy consuming. Increased quality of diet might improve the health of adults, but it does not provide any more time to feed and care for children in the cultivating seasons. In The Gambia, it has been shown that one of the factors causing very high infant and child mortality is the peaking of stress at the beginning of the rainy season when food is scarce (Billewicz and McGregor, 1981). The rains bring a rapid rise in the prevalence of malaria and the women have to leave their children with little supervision to go and cultivate. Improvements in nutrition could lead to decreased adult morbidity at this time but would have little effect on the children.

The within-group differential in Twareg infant and child mortality is hard to explain given that the two classes live in the same environment and usually the same camps. A couple of possible explanations concern the health and role of the mother. Ideally, "free" Twareg women do little or no work, and they may be extremely fat and immobile (weighing up to 100 kg), whereas Bella women are far more active, putting up tents, cooking and pounding grain. However the rigours of nomadic life do not involve the Bella women in continuous, very strenuous work, particularly among the Twareg surveyed here, who, living in the inland Niger delta, do not get their water from wells but generally from ponds and marshes. This contrasts with Bambara women, much of whose time is spent strenuously pulling water from very deep wells, as well as participation in very labour-intensive agricultural work.

From the rather fragmentary observations made during the five months of demographic fieldwork, a spectrum of women's health and fitness can be tentatively delineated. This spectrum ranges from: Bambara women who endure continuous heavy work, possibly to the extent that child welfare suffers badly as seasons when agricultural demands on the mother are very heavy, and they are unable to care for and feed their children properly: through to Bella women who do enough active work to keep fit, and yet whose labour demands are not so severe that their children are ignored, or that their own health suffer unduly. Further along are the "free" Twareg women who rarely do any active work, are often grossly fat, probably to the detriment of their own health, and possibly generating a lack of impetus and energy to look after their own children and survey tham as much as is necessary. It is also possible that Bella and "free" Twareg children have different feeding practices, as Bella women generally prepare the food, which comes from various sources, and hence their children may have more access to food.

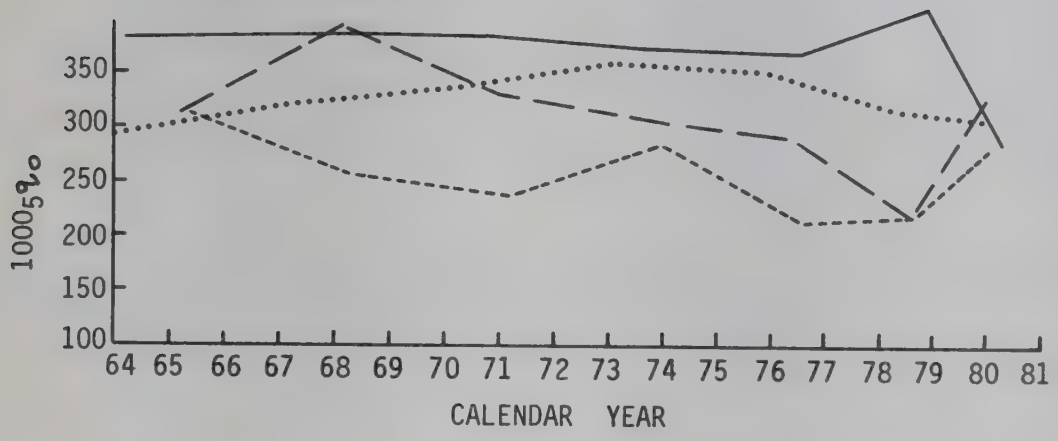
Figure 9 compares $1000._5q_0$ (the mortality between birth and age 5) for the four sub-groups. It is clear that the Bella children have the best survival, whichever data set is considered. From the birth history data, which one would expect to be the more reliable concerning dead children, there does seem to be a gradient in mortality from Doura, through Monnimpé and "free" Twareg to the lower mortality of Bella. The household data only differentiate Bella mortality, which appears better than any of the others. It seems possible that Bella maximise the time and care they are able to give their children along with retaining the fitness and health to do so. Certainly the environment in terms of climate, water, and facilities can play little role as both "free" Twareg and Bella live in the same places.

Another tentative explanation for some of the difference between Twareg and Bambara infant and child mortality is the different weaning foods available. The Bambara diet is predominantly millet, which can be cooked in various forms, but that which is fed to young children is often a watery soup. This would have to be consumed in bulk to provide the child with enough nourishment. The Twareg diet, primarily milk products, has the advantage of being a more complete food in less bulk. Also, milk straight from the animal is less likely to get infected than millet soup left open and sitting for some time. Current and future nutrition studies amongst the two groups will look at weaning foods and hope to confirm whether there are major differences in feeding habits. From the birth history data, we know that there are no major differences in breastfeeding practices. Bambara women breastfeed for a mean of 18.5 months and Twareg women for 19.4 months with no differences by sub-group. Thus, any nutritional differences probably occur during weaning and later.

Figure 9.

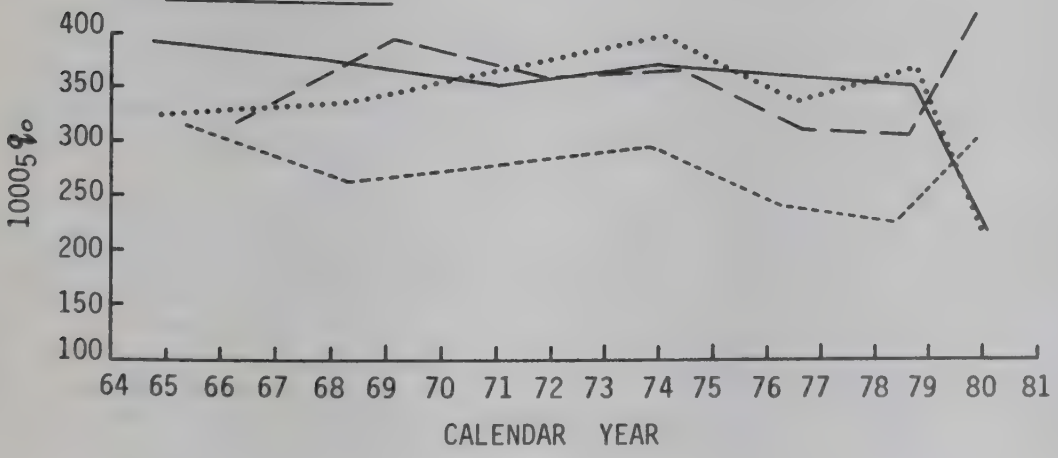
Bambara and Twareg 1000_5q_0 estimated from -

(a) Birth history data



Bambara and Twareg 1000_5q_0 estimated from -

(b) Household data



——— Doura

····· Monnimpé

— — — — "Free" Twareg

---------- Bella +

4. FERTILITY

The central delta of Mali contains a variety of production systems and ways of life ranging from completely nomadic pastoralist Twareg through agro-pastoralist Fulbé to the sedentary Bambara millet farmers. It thus provides a test of the hypothesis that the fertility of nomads is substantial lower than that of sedentary groups, and that as nomads sedentarise, their fertility rises. Henin's work on Baggara nomads in Sudan (Henin, 1968, 1969) shows just this, and Bernus's summary of demographic studies on Twareg and Peul in Niger indicates that several surveys there have shown an internal gradient of fertility according to degree of sedentarisation (Bernus, 1981, pp. 115-118).

The results presented here are for two extreme groups of this spectrum: Twareg and Bambara. No sedentary Bella were interviewed, but many of the nomadic Bella work as seasonal labourers for farmers in the harvest season - thus they are a step closer to the sedentary groups than the purely pastoralist "free" Twareg.

4a Methods of fertility estimation

In retrospective surveys of this kind, there are various ways of estimating fertility levels from the data. The P/F ratio method is well established and reliable in cases where the data is of a reasonable quality, as here. Fertility data collected in this type of single round survey, come in two forms; mean parities for age groups of women (from their declared total children ever born) and current age specific fertility rates (from births in the twelve months preceding the interview). Both of these are subject to errors, but it is assumed that for younger women in their twenties and early thirties, the parity data are accurate regarding level of fertility.

The age pattern of fertility for ages 15-50 from the current fertility data is assumed to be correct but the level may be wrong due to systematic errors in the reference period used. Using these assumptions, the ratios between the cumulated current fertility data and the parities are calculated for each age group. The mean ratio for younger, more reliable age groups is used to correct the reported age specific fertility data, providing an estimate of the total fertility rate (TFR). This total fertility rate is the number of children a woman would have borne by age 49 if she experienced the calculated age specific fertility rates throughout her childbearing years. In these Malian groups none of the obvious forces likely to change fertility are operating. There is no mass treatment campaign against venereal diseases, neither is there a major family planning programme, or rapid increase in female education levels.

Figure 10.

Bambara reported current fertility and parity

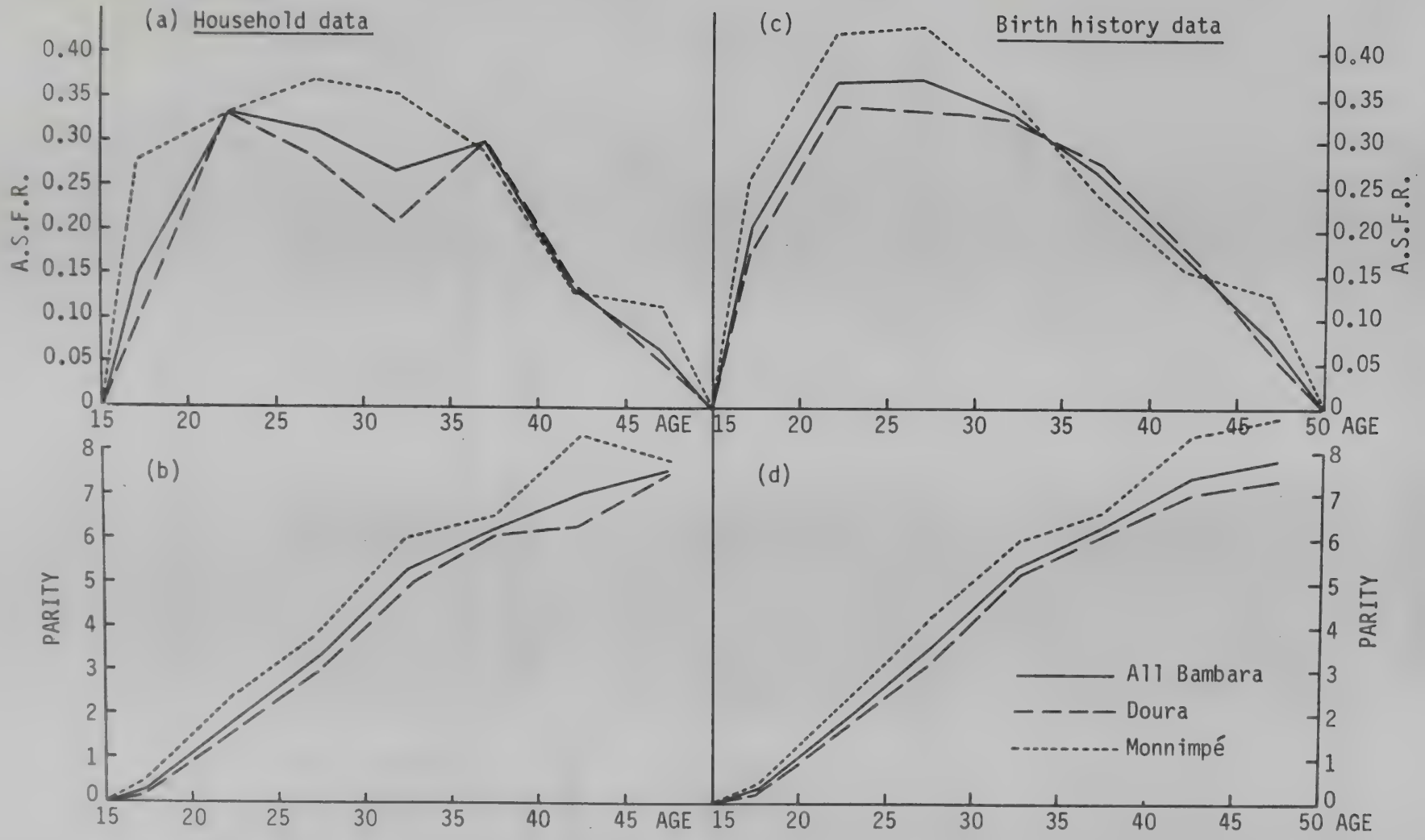


Table 10

BAMBARA PARITY, CURRENT FERTILITY AND P/F RATIOS - HOUSEHOLD DATA

a) All Bambara

Age	Total Women	CEB*	BLYR+	Parity	Asfr.	P/
15-19	490	153	73	.312	.149	.9
20-24	450	853	149	1.896	.331	1.0
25-29	399	1136	125	3.348	.313	.9
30-34	321	1705	83	5.311	.259	1.1
35-39	272	1688	81	6.206	.298	1.0
40-44	181	1277	25	7.055	.138	.9
45-49	175	1323	12	7.560	.069	.9

$5.\Sigma = 7.78$

b) Doura

Age	Total Women	CEB	BLYR	Parity	Asfr.	P/
15-19	347	75	34	.216	.098	1.0
20-24	303	500	100	1.650	.330	1.1
25-29	269	829	77	3.082	.286	1.0
30-34	214	1063	45	4.967	.210	1.1
35-39	203	1239	61	6.103	.300	1.0
40-44	120	766	17	6.383	.142	.9
45-49	132	987	7	7.477	.053	1.0

$5.\Sigma = 7.10$

c) Monnimpé

Age	Total Women	CEB	BLYR	Parity	Asfr	P/
15-19	143	78	39	.545	.273	.8
20-24	147	353	49	2.401	.333	1.0
25-29	130	507	48	3.900	.369	.9
30-34	107	642	38	6.000	.355	1.0
35-39	69	449	20	6.507	.290	.8
40-44	61	511	8	8.377	.131	1.0
45-49	43	336	5	7.814	.116	.8

$5.\Sigma = 9.34$

* CEB = Children ever born
\+ BLYR = Births in the last year

Asfr = Age specific ferti
rate from BLYR

Table 11

BAMBARA PARITY, CURRENT FERTILITY AND P/F RATIOS - BIRTH HISTORY DATA

a) All Bambara

Age	Total Women	CEB	BLYR	Reported Parity	Reported asfr	P/F
15-19	292	87	58	.298	.199	.655
20-24	383	711	141	1.856	.368	.893
25-29	333	1193	124	3.583	.372	.902
30-34	243	1312	81	5.399	.333	944
35-39	194	1227	52	6.325	.268	.881
40-44	199	1482	34	7.447	.171	.912
45-49	138	1077	11	7.804	.080	.881

$5.\Sigma = 8.96$

b) Doura

Age	Total Women	CEB	BLYR	Reported Parity	Reported asfr	P/F
15-19	203	55	35	.271	.172	.691
20-24	260	440	89	1.692	.342	.899
25-29	208	665	70	3.197	.337	.890
30-34	175	910	57	5.200	.326	.992
35-39	136	839	38	6.169	.279	.916
40-44	142	1005	25	7.078	.176	.906
45-49	98	725	6	7.398	.061	.881

$5.\Sigma = 8.47$

c) Monnimpé

Age	Total Women	CEB	BLYR	Reported Parity	Reported asfr	P/F
15-19	89	32	23	.360	.258	.601
20-24	123	271	52	2.203	.423	.871
25-29	125	528	54	4.224	.432	.891
30-34	68	402	24	5.912	.353	.886
35-39	58	388	14	6.690	.241	.829
40-44	57	477	9	8.368	.158	.947
45-49	40	352	5	8.800	.125	.897

$5.\Sigma = 9.95$

4b Fertility levels and patterns

Figure 10 shows reported parities and current fertility for the Bambara both from the household data and the birth histories. From both data sets the parity data appear consistent. Monnimpé has higher fertility than Doura throughout, and apart from the Monnimpé household data, there is little evidence of under-reporting at older ages. The pattern of current fertility does show some idiosyncracies. The Doura and overall pattern from the household data have a curious bi-modal distribution. This is very similar to the distribution obtained for Bambara in the 1956-8 "Enquête Démographie dans le Delta Central Nigérian", and is probably caused by age misreporting. It is at earlier ages that the two groups differ most, with Monnimpé women having much higher fertility at the younger ages, not only before age 20 but up to age 35, indicating that the higher fertility is not solely a result of earlier marriage.

Tables 10 and 11 show the P/F ratios for both areas from the household and individual interviews. The higher ratios from the household data are merely an indication that the household head's idea of a 12 month period was shorter than that of the women. The series are reasonably smooth given that knowledge of age was rather approximate. One expects the ratio for 15-19 year olds to be out of line because women bearing children at this age are atypical for many reasons. There is no evidence of underreporting of parities by older women, which would lead to a gradual decrease in the P/F ratios. Some of the unevenness may be due to genuine major fluctuations in fertility in a situation where a small homogenous group is very susceptible to annual variation with hardship due to drought or other calamities.

Table 12

BAMBARA TOTAL FERTILITY RATES ESTIMATED USING P/F RATIO METHOD

	ALL	DOURA	MONNIMPE
Household File	8.12	7.54	9.25
Birth History File	8.04	7.58	8.77

Notes: Derived using the mean of P_2/F_2 and P_3/F_3 to correct the level of reported age specific fertility, except for Monnimpé household where the mean of P_2/F_2, P_3/F_3 and P_4/F_4 was used.

Table 12 shows the Bambara total fertility rates estimated using the average of the P/F ratios over the age range 20-29. The estimates from the two data sources are consistent with each other and, although both areas have very high

total fertility, fertility in Monnimpé is clearly much higher than in Doura, with a difference of over one child per woman. Crude birth rates calculated from the adjusted age specific fertility rates are 57.1 per thousand for all Bambara, 53.3 per thousand for Doura and 63.7 per thousand for Monnimpé.

The Twareg data are slightly more irregular than the Bambara. Figure 11 shows reported parities and current fertility from both household and individual data sources. There is evidence of underreporting at older ages in both data sets. The pattern of fertility is certainly different between the two sub-groups of the population, with Bella fertility higher at younger ages and peaking much earlier than the "free" Twareg. The fertility pattern of the latter has a very late peak for a non-contracepting group in Africa. At older ages both pattern and level are similar for the two groups. Both parity data sets reflect higher younger Bella fertility until age 30, with the "free" Twareg then catching up.

Tables 13 and 14 show the P/F ratios for all Twareg and the sub-groups. The tailing off in each set is due primarily to omission of children by older women. Again, the household heads were using a shorter reference period than the women. The series are quite even, and the gradual decline never occurs before age 35 so we are justified in using the mean ratio of the younger ages for correction. Table 15 shows the estimated total fertility rates (using the P/F ratio method) which are very similar for both sub-groups.

Table 15

TWAREG TOTAL FERTILITY RATES ESTIMATED USING P/F RATIO METHOD

	ALL	FREE TWAREG	BELLA AND BLACKSMITHS
Household File	6.52	6.62	6.45*
Birth History File	5.99	5.89	5.98

Notes: Total fertility estimated using the average of P_2/F_2 and P_3/F_3 to adjust reported age specification fertility (birth and the preceding 12 months) except for the values starred where the mean of P_2/F_2, P_3/F_3, P_4/F_4 was used.

Figure 11.
Twareg reported current fertility and parity

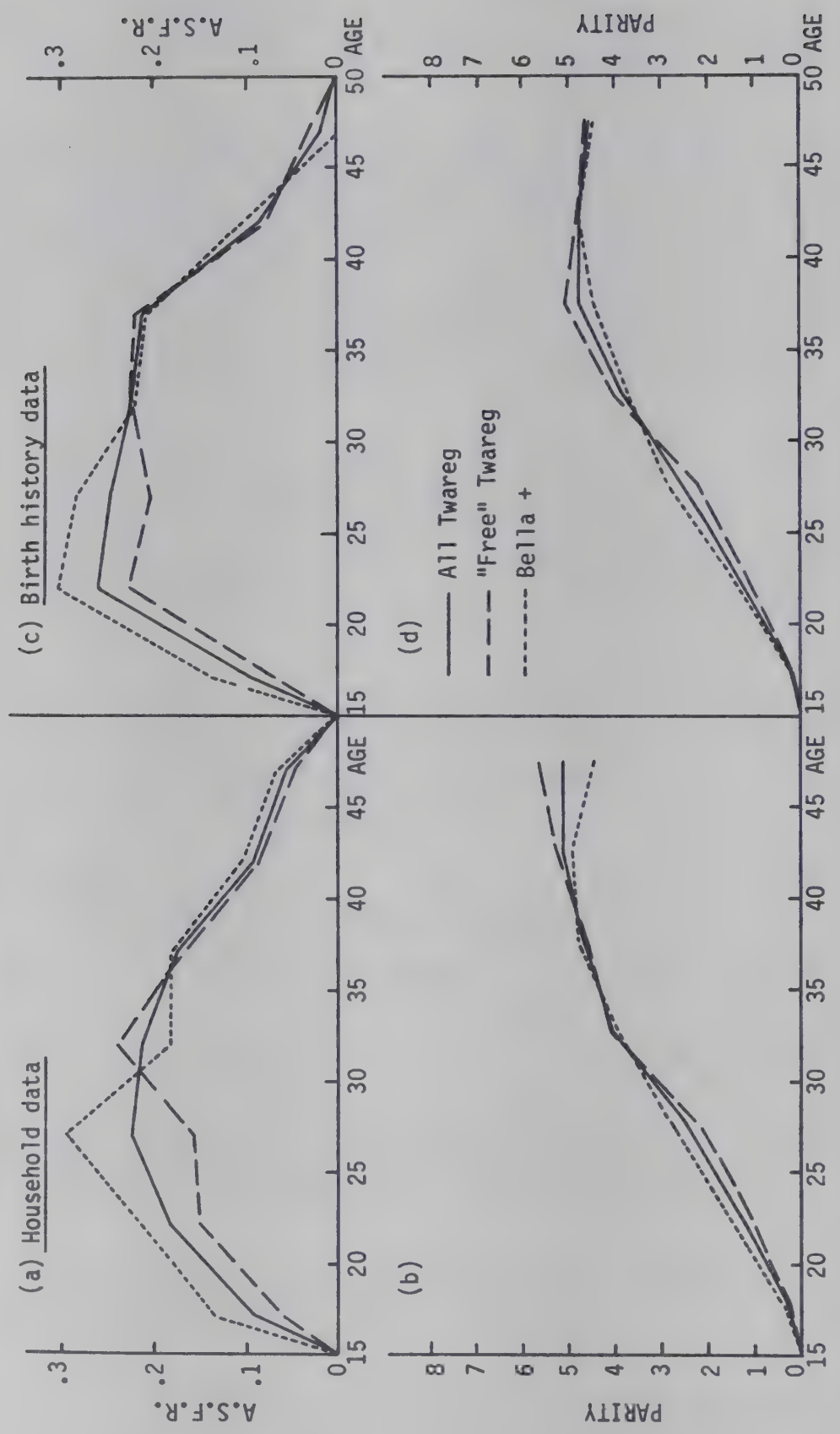


Table 13

TWAREG PARITY, CURRENT FERTILITY AND P/F RATIOS - HOUSEHOLD DATA

a) All Twareg

Age	Total Women	CEB	BLYR	Reported Parity	Reported asfr.	P/F
15-19	280	69	26	.246	.093	1.155
20-24	310	398	56	1.284	.181	1.312
25-29	286	704	64	2.462	.224	1.207
30-34	235	935	50	3.979	.213	1.269
35-39	131	613	23	4.679	.176	1.141
40-44	118	605	11	5.127	.093	1.104
45-49	70	360	4	5.143	.057	1.006

$5.\Sigma = 5.18$

b) Free Twareg

Age	Total Women	CEB	BLYR	Reported Parity	Reported asfr.	P/F
15-19	152	29	9	.191	.059	1.440
20-24	160	171	24	1.069	.150	1.426
25-29	147	322	23	2.191	.157	1.487
30-34	130	526	31	4.046	.239	1.576
35-39	71	327	12	4.606	.169	1.296
40-44	70	368	6	5.257	.086	1.291
45-49	40	227	2	5.675	.050	1.265

$5.\Sigma = 4.54$

c) Bella & Blacksmiths

Age	Total Women	CEB	BLYR	Reported Parity	Reported asfr.	P/F
15-19	128	40	17	.313	.133	1.008
20-24	150	227	32	1.513	.213	1.216
25-29	139	382	41	2.748	.295	1.031
30-34	105	409	19	3.895	.181	1.041
35-39	60	286	11	4.767	.183	1.019
40-44	48	237	5	4.938	.104	.938
45-49	30	133	2	4.433	.068	.764

$5.\Sigma = 5.88$

Table 14

TWAREG PARITY, CURRENT FERTILITY AND P/F RATIOS - BIRTH HISTORY DATA

a) All Twareg

Age	Total Women	CEB	BLYR	Parity	Asfr.	P/F
15-19	239	53	22	.222	.092	1.124
20-24	301	398	79	1.322	.263	1.067
25-29	243	620	60	2.551	.247	1.012
30-34	196	757	44	3.862	.225	1.951
35-39	130	623	28	4.792	.215	.994
40-44	102	486	9	4.765	.088	.866
45-49	54	247	1	4.574	.019	.800

$5.\ \mathcal{E} = 5.74$

b) Free Twareg

Age	Total Women	CEB	BLYR	Parity	Asfr	P/F
15-19	139	29	9	.209	.065	1.564
20-24	166	197	38	1.187	.229	1.170
25-29	117	258	24	2.205	.205	1.064
30-34	106	425	24	4.009	.226	1.267
35-39	73	371	16	5.082	.219	1.171
40-44	63	302	5	4.794	.079	.968
45-49	32	149	1	4.656	.031	.889

$5.\ \mathcal{E} = 5.28$

c) Bella & Blacksmiths

Age	Total Women	CEB	BLYR	Parity	Asfr.	P/F
15-19	100	24	13	.240	.130	.837
20-24	135	201	41	1.489	.304	.964
25-29	126	362	36	2.873	.286	.941
30-34	90	332	20	3.689	.222	.866
35-39	57	252	12	4.421	.211	.823
40-44	39	184	4	4.718	.103	.766
45-49	22	98	0	4.455	.000	.710

$5.\ \mathcal{E} = 6.27$

During the household interviews, we often found that the men included children from previous marriages in the current wife's children. Where possible this was rectified, but it may explain the consistently higher fertility estimates from the household data.

It seems that the level of Twareg fertility as measured by the estimated total fertility rate is no different by sub-group. However, the reports on current fertility indicate that the age pattern of fertility does vary, with "free" Twareg having their children much later than Bella. The crude birth rate for the Twareg as a whole is 48.8 per 1000; for the "free" Twareg 48.8 per 1000 and the Bella and blacksmiths 49.3 per 1000.

4c Fertility levels compared: marital fertility

In summary, we can say that Bambara fertility is substantially higher than that of the Twareg, a difference of the order of 1 to 2 children per woman. Between the Twareg sub-groups there is no difference, despite the big differences in infant and child mortality. Between the two Bambara areas there are differences with the richer, less marginal area having much higher fertility. Why do these differences occur? The key to this question is probably the marriage patterns. For the "free" Twareg, sexual relations before and outside marriage are condemned, although Bella may have an illegitimate child or even more than one before marrying, although this is rare. Bambara women are not suppposed to have children prior to marriage, but there is a social custom whereby a young girl can spend the rainy season before her marriage in the nome of her fiancé. She is "lent" to help out in her future home. Although she will return home before she finally does marry, some women get pregnant in this period and may have the child before the marriage takes place. Quite a few examples of these unmarried mothers were found. Some shame was obviously accorded to the position because frequently these births were not declared in the original questionning of the household head, but when such women were seen to be breastfeeding an infant, they were subsequently re-questioned. From other data in Dalonguébougou we know that an older woman whose first child was known to be illegitimate did not declare this child, neither did it appear on any of the household forms as a resident. There is no way of knowing how many other illegitimate children were similarly omitted.

Figure 12 shows that by age 27 all Bambara women have been married, whereas about 5 per cent of Twareg women never marry and by age 25, 18 per cent are still unmarried Even more significantly, Figure 13 indicates that over 95 per cent of Bambara women are currently married from age 22 until the end of childbearing After a divorce or widowhood they remarry very rapidly. The levirate is practised whereby a man may inherit his dead brother's wives. Only about 70 per cent of Twareg women are currently married in the child bearing ages and, for the "free" Twareg at least, as sexual relations are only permitted within marriage, 30 per cent of women are therefore not exposed to the risk of childbearing. Proportions currently married are not significantly different between free Twareg and Bella. The proportion currently divorced is consistently quite high among Twareg women being between 7 and 12 per cent for most of their fertile years (Figure 13). These differences in marriage patterns and proportions currently married account for most of the differences in fertility between the two groups.

Figure 12.

Percentage never married by age (birth history data)

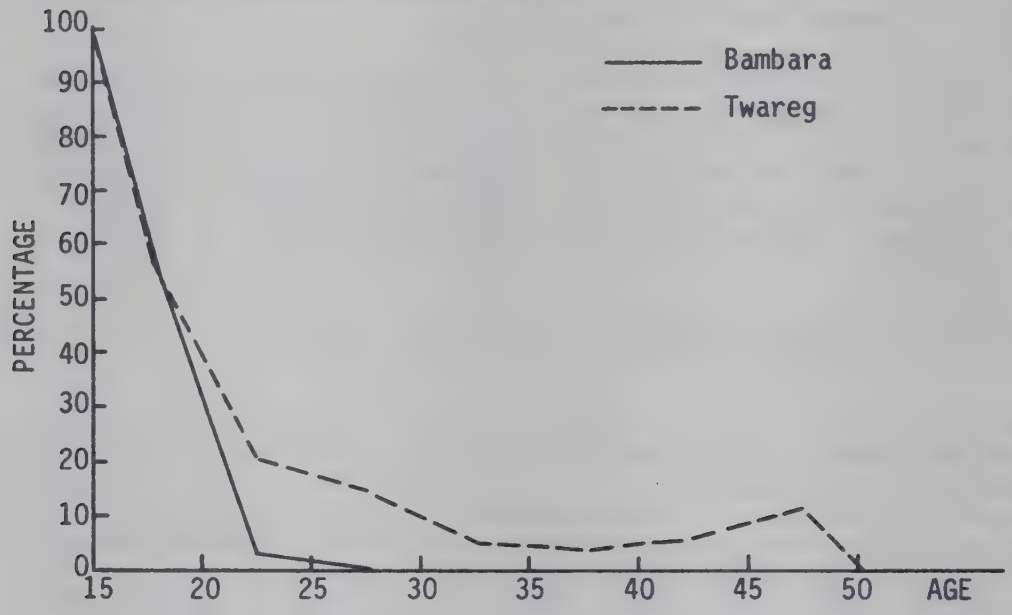
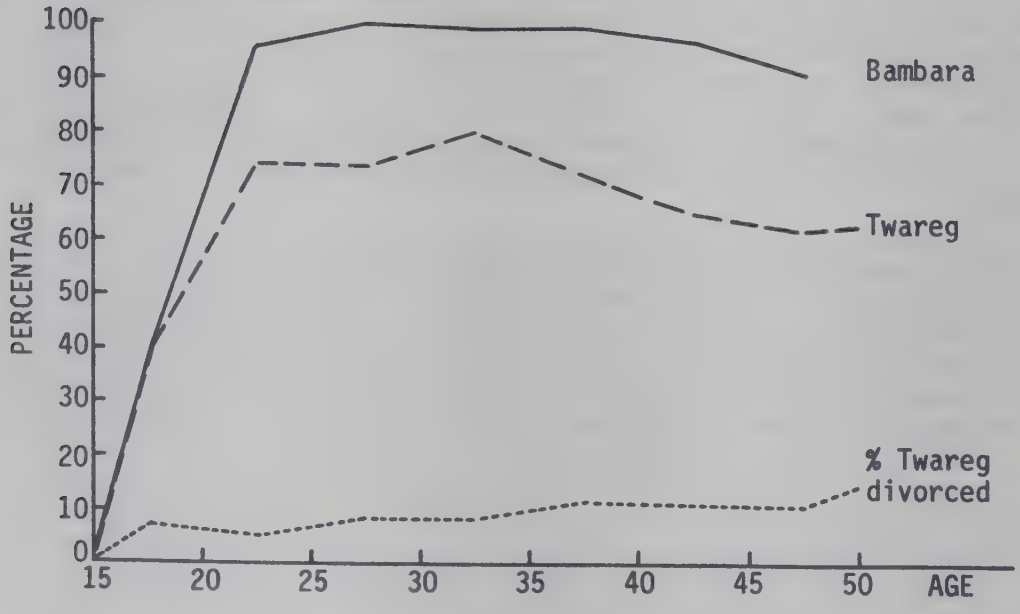


Figure 13.

Percentage currently married by age (birth history data) and percentage of divorced Twareg



Tables 16 and 17 show estimates of marital fertility from the birth history data. Apart from Bambara 15-19 year olds, all estimates were made using the adjusted age specific fertility rates obtained from the P/F estimates (birth history data). These were divided by the proportions currently married, to give a current marital fertility rate, and then cumulated to give the total marital fertility rate. This is the number of children a woman would expect to have if she were continuously married thoughout her childbearing years and experiencing these age specific fertility rates. The difference between this figure and the total fertility rate for all women indicates the effect that non-marriage, age at marriage and periods between marriages have on fertility. Bambara 15-19 year olds were treated differently because much of this group's fertility is outside marriage, some entering marriage already pregnant. This gives an exaggerated marital fertility rate using the above method, so births in the preceding 12 months to currently married women were corrected for level by the mean of P_2/F_2 and P_3/F_3 and used as the 15-19 marital age specific fertility rate.

It can be seen that the differences between these total marital fertility rates are negligible, both within and between groups. The Twareg rate is the same level as the Bambara indicating that most of the reasons behind fertility differences lie in the marriage pattern. The Doura-Monnimpé differential is reduced quite considerably though the remaining difference indicates that there may possibly be some slight difference in the fecundity of women, maybe due to the better Monnimpé diet. It is obvious that the earlier marriage in Monnimpé (65.2 per cent of 15-19 year old women are married in Monnimpé compared with only 27.1 per cent of 15-19 year old Doura women) does play some part in the higher fertility of this group.

The next step is to consider why the Twareg marriage pattern is so different. Late age at marriage and a high percentage never marrying usually occur only in more developed countries where women have sought roles other than those of mother and wife. Otherwise, they may result from economic hardship and lack of the prerequisites for marriage. In a pastoralist economy, all capital is in livestock, and an independent household needs a certain number of animals to be viable. Amongst the Bambara, bride price is low and a man rarely becomes a household head before the death of his father, with the newly married couple forming part of the extended patrilineal household. For Twareg, a couple forms a new household at the moment of marriage. Hence, for the marriage to occur, there are prerequisites in terms of housing - a tent, and livestock. If these are not forthcoming, the marriage cannot occur. It seems likely that in times of hardship when herds are not reproducing, few marriages will occur, and this loss will never be made up. A Bambara household, where more labour leads to increased production, times of hardship are less likely to inhibit marriage for a new wife means more hands and the prospect of further assistance from future offspring.

Table 16

BAMBARA MARITAL FERTILITY (BIRTH HISTORY DATA)

1) All Bambara

Age	Proportion curr. married (1)	corrected* asfr. (2)	marital asfr (2/1) (3)	cumulated asmfr. (4)
15-19	.387	.207	.366 +	1.830
20-24	.958	.335	.350	3.580
25-29	.994	.333	.335	5.255
30-34	.984	.295	.300	6.755
35-39	.985	.235	.239	7.950
40-44	.960	.141	.147	8.685
45-49	.899	.061	.068	9.020 TM

2) Doura

Age	Proportion curr. married (1)	corrected* asfr. (2)	marital asfr (2/1) (3)	cumulated asmfr. (4)
15-19	.271	.180	.375 +	1.877
20-24	.950	.311	.327	3.514
25-29	.995	.302	.303	5.031
30-34	.983	.289	.294	6.502
35-39	.985	.245	.248	7.743
40-44	.964	.145	.150	8.495
45-49	.898	.045	.050	8.743 TM

3) Monnimpé

Age	Proportion curr. married (1)	corrected* asfr. (2)	marital asfr (2/1) (3)	cumulated asmfr. (4)
15-19	.652	.263	.349 +	1.747
20-24	.976	.375	.384	3.669
25-29	.992	.377	.380	5.570
30-34	.985	.302	.307	7.104
35-39	.983	.207	.211	8.157
40-44	.947	.125	.132	8.815
45-49	.900	.104	.116	9.394 TM

* Corrected for level using P/F ratios

\+ From raw data on births in preceding 12 months to currently married women aged 15-19. This method is used because many Bambara girls g pregnant or have a child before marriage.

Table 17

TWAREG MARITAL FERTILITY (BIRTH HISTORY DATA)

1) All Twareg

Age	Proportion curr. married (1)	corrected* asfr. (2)	marital asfr (2/1) (3)	cumulated asmfr. (4)	
15-19	.381	.116	.303	1.517	
20-24	.741	.280	.378	3.404	
25-29	.733	.255	.348	5.147	
30-34	.791	.232	.294	6.614	
35-39	.715	.216	.302	8.123	
40-44	.647	.081	.125	8.749	
45-49	.611	.014	.024	8.866	TMFR

2) "Free" Twareg

Age	Proportion curr. married (1)	corrected asfr. (2)	marital asfr (2/1) (3)	cumulated asmfr. (4)	
15-19	.396	.089	.224	1.120	
20-24	.717	.263	.367	2.953	
25-29	.726	.231	.318	4.542	
30-34	.821	.254	.309	6.086	
35-39	.699	.235	.336	7.767	
40-44	.635	.080	.125	8.393	
45-49	.625	.028	.045	8.618	TMFR

3) Bella

Age	Proportion curr. married (1)	corrected asfr.(2) (2)	marital asfr (2/1) (3)	cumulated asmfr (4)	
15-19	.360	.148	.411	2.057	
20-24	.770	.294	.382	3.965	
25-29	.738	.268	.363	5.778	
30-34	.756	.210	.277	7.162	
35-39	.737	.195	.264	8.482	
40-44	.667	.082	.123	9.096	
45-49	.591	.000	.000	9.096	TMFR

* - Corrected level of age specific fertility rate from P/F estimation of fertility

5. RESULTS FROM THE 1956-58 AND 1960-61 SURVEYS AND THE CENSUS OF 1979

The French Mission Socio-économique du Soudan (October 1956 - April 1958) was established to compare the standard of living of the settlers in the zone under the control of the Office du Niger, a régie set up in 1932 to commercialize the production of rice and cotton, with the living standards of the population elsewhere in the delta. The Mission conducted a number of surveys but the demographic survey was the largest, involving the enumeration of about 25,000 persons in a carefully designed sample which, when weighted, produced a total of 235,295 people for analysis. Their distribution by ethnic group is shown on Table 18. The results give a rather good overall view of the demography of the delta since the survey included both a household questionnaire and an interview for women of child-bearing age, the latter containing the main retrospective questions on life-time fertility and child mortality. Results are tabulated by ethnic group which facilitates comparison with the 1981 surveys.

The 1960-61 survey was an even larger study covering the whole country with the exception of the Office du Niger zone, the thinly populated north eastern third of the country and the Gurma-Rharous region in the Niger river bend south east of Timbuctoo. The weighted total population for which results are presented is 3.5 millions. Almost the same methodology was used as in the 1956-58 survey, that is, a household questionnaire and a separate interview for women 14 years old and over. Some of the retrospective results on fertility and child mortality were tabulated by ethnic group but there are important gaps which make comparison with the 1956-58 or the 1981 surveys impossible. The most numerous ethnic groups separately identified were: the Bambara (44 per cent), the Fulani (13 per cent), the Sarakollé (13 per cent), the Sénoufo (9 per cent), and the Sonrai (7 per cent).

By comparison with the previous two surveys, the first census of December 1976 used a much less detailed questionnaire although it did cover virtually the whole population of Mali. In fact, apart from the detailed tables by district showing the population by age and sex, the data of most value for demographic analysis are the tabulations of household deaths reported for the 12 months preceding the census. No other retrospective questions on fertility or mortality were asked except for a single question on births in the household in the preceding 12 months. Since these births were not linked in any way with the mother who bore them, they are largely useless for demographic analysis.

5a Mortality

Brass first looked at the 1956-58 survey results in the early 1960's and the methods he developed at that time for estimating child mortality and current fertility are essentially the same as used today (see Brass *et al.*, 1968, for details) In Table 19, the 1956-58 data for the whole delta population have been used to re-calculate child mortality using the same

Table 18

POPULATION BY ETHNIC GROUP AND SEX FROM THE 1956-58 SURVEY OF THE NIGER DELTA

ETHNIC GROUP	MALES	FEMALES	TOTAL
Moors, Free Twareg etc.	170	140	310
Bella	540	505	1 045
Fulani - Fulbé	21 400	24 020	45 420
Fulani Castes and Toucouleur	3 065	3 325	6 390
Fulani - Rimaïbé	29 450	30 315	59 765
Bambara and related	16 335	16 655	32 990
Marka	13 455	13 850	27 305
Somono	2 805	3 120	5 925
Bozo	23 095	23 480	46 575
Others	4 930	4 640	9 570
Total	115 245	120 050	235 295

Source: Etude démographique... (1956-58), vol 2, table 2.1.

Note: The Bella are the descendants of the slaves or captives of the free Twareg. The Rimaïbé are the descendants of the agricultural dependants of the Fulbé.

In this report, free Twareg and Bella are collectively known as Twareg; Fulbé and Rimaïbé as Fulani, except where specified.

Table 19

CHILD MORTALITY ESTIMATES FROM THE 1956-58 SURVEY OF THE NIGER DELTA
(Fieldwork January-May 1957)

Age of Women	X	Proportions Dead of Children Everborn	q_x	q_5	Approximate Date of Estimate
15-19	1	.388	.289	.511	1955.7
20-24	2	.440	.414	.516	1954.2
25-29	3	.454	.444	.488	1952.2
30-34	5	.483	.487	.487	1950.2
35-39	10	.483	.499	.464	1947.5
40-44	15	.511	.519	.467	1944.9
45-49	20	.510	.510	.438	1941.8

Source of data: Etude Démographique ... (1956-8) vol. 2, table 3-21.

procedures as applied to the 1981 results. They show that infant and child mortality were high and apparently unchanging in the period before the 1956-58 Mission; nearly half of all babies died before reaching age 5. Unpublished data provided by Brass for the Mopti zone within which most of the 1981 Twareg and Bambara surveys took place, indicate a level of child mortality close to the average for the whole delta (Table 20). Differences between the ethnic groups are more marked; as in the data from the 1981 surveys, it is the semi-nomads, here the Fulani (Fulbé) with the lowest child mortality and the Bambara farmers with the highest rates (Table 21).

Although the question on deaths in the 12 months preceding the survey was asked, it was included on the women's questionnaire rather than on the household form. Perhaps for this reason, the plot of the reported birth and death rates for five-year age sections is extremely irregular, effectively obviating the possibility of using the Brass Growth Balance technique to estimate the level of adult mortality.

From the 1960-61 survey covering most of Mali, child mortality can be calculated by several methods from the data available but the Brass method applied to the proportions dead of children everborn probably gives the most robust estimates (Table 22). Frustratingly, the data necessary to calculate child mortality by ethnic group by the same method are not published in the reports, but from a table of the proportions of dead children for women aged 50 and over, it seems that the differences in child mortality between the Fulani and the Bambara were slight (Enquête Démographique... 1960-61, p. 124, table 59). Other tables (eg, proportions dead of children born in the preceding 12 months - p. 128, table 61) tell the same story. From the uncorrected household deaths reported in the 12 months before the survey, there is a suggestion that the crude death rate of the agricultural Bambara was above that of the semi-nomadic Fulani (Enquête Démographique... 1960-61, p. 131, table 64).

Turning to the 1976 census data, from which we can at least estimate adult mortality, we find that adult mortality was low in relation to child mortality when comparisons are drawn with model patterns.. This can be clearly seen from a comparison of the ${}_5q_0$ values from the 1956-58 and the 1960-61 surveys with the value extrapolated from the 1976 estimate of adult mortality:

			${}_5q_0$
1976	: males	(from adult mortality)	.275
	females	(from adult mortality)	.309
1956-58	: indirect estimate		.481
1960-61	: indirect estimate		.365

The 1976 census did not collect data on ethnicity but some indication of the level of adult mortality can be obtained for the separate administrative "régions" of Mali. For the Gao region, for example, where approximately half the enumerated population was classified as nomadic, adult mortality was much worse than for the whole country, thus being more in line with the child

Table 20

CHILD MORTALITY IN THE MOPTI AREA FROM THE 1956-58 SURVEY OF THE NIGER DELTA

AGE OF WOMEN	X	PROPORTIONS DEAD OF CHILDREN EVERBORN	q_x	q_5	APPROXIMATE DATE OF ESTIMATE
15-19	1	.365	.241	.428	1955.9
20-24	2	.453	.413	.515	1954.3
25-29	3	.467	.452	.497	1952.3
30-34	5	.493	.496	.496	1950.1
35-39	10	.469	.485	.450	1947.7
40-44	15	.488	.496	.445	1945.1
45-49	20	.489	.489	.418	1942.1

Source of data: W. Brass et al. (1968) The Demography of Tropical Africa, Part II, Chapter 7.

Table 21

CHILD MORTALITY BY ETHNIC GROUP FROM THE 1956-58 SURVEY OF THE NIGER DELTA

Age of Women	Age of x	Proportions Dead of Children Everborn	q_x	q_5	Approx. Date of Estimate
FULANI - FULBE					
15-19	1	.335	.190	.332	1955.5
20-24	2	.368	.334	.417	1954.0
25-29	3	.393	.387	.426	1952.2
30-34	5	.407	.417	.417	1950.2
35-39	10	.443	.467	.434	1948.2
40-44	15	.469	.486	.436	1945.9
45-49	20	.454	.462	.394	1943.0
FULANI - RIMAÏBE					
15-19	1	.391	.294	.519	1955.9
20-24	2	.439	.405	.505	1954.3
25-29	3	.448	.427	.469	1952.1
30-34	5	.469	.461	.461	1949.5
35-39	10	.469	.474	.441	1946.7
40-44	15	.495	.493	.442	1943.9
45-49	20	.520	.511	.438	1940.8
BAMBARA					
15-19	1	.360	.317	.557	1956.0
20-24	2	.400	.398	.497	1954.7
25-29	3	.466	.465	.511	1952.7
30-34	5	.472	.479	.479	1950.5
35-39	10	.478	.496	.461	1948.0
40-44	15	.528	.538	.485	1945.3
45-49	20	.488	.490	.419	1942.2

Table 22

CHILD MORTALITY ESTIMATES FROM THE 1960-61 SURVEY OF MALI

(Fieldwork June 1960 - May 1961)

Age of Women	x	Proportions Dead of Children Everborn	q_x	q_5	Approx. Date of Estimate
15-19	1	.232	.184	.321	1959.6
20-24	2	.302	.287	.358	1958.1
25-29	3	.350	.340	.374	1956.0
30-34	5	.376	.376	.376	1953.7
35-39	10	.399	.409	.379	1951.1
40-44	15	.421	.425	.379	1948.3
45-49	20	.436	.433	.368	1945.3

Source of data: Etude Démographique ... (1960-61) p. 123, table 58.

mortality estimates from the 1956-58, 1960-61 and 1981 surveys.

Undoubtedly the most intriguing aspect of this older survey material is the opportunity it provides to look at changes in child mortality over quite a long period. The data from all three surveys have been plotted on Figure 14. From the first two surveys, it seems that child mortality was higher in the delta than in the rest of Mali. Within the delta, the semi-nomadic Fulani (Fulbé) had lower child mortality than either the Bambara millet farmers or the Fulani (Rimaïbé) who are mostly settled rice cultivators. In the 1981 survey, most of the Bambara interviewed lived in the quite marginal arrondissement of Doura where rainfall totals are lower and more variable than in the areas where the bulk of the Bambara live. Hence, the 1981 results are likely to be an over-estimate of child mortality for all Bambara in Mali. Neither the 1956-58 nor the 1981 survey results for the Bambara show any pronounced downward trend and it looks very much as if the two sets of data are parts of separate series (Figure 14). In any case, neither in the arrondissement of Doura nor in the richer Monnimpé has much improvement in child mortality taken place in the two decades before the 1981 surveys. Unfortunately, no earlier data are available on Twareg child mortality but the level prior to 1981 shows no marked improvements (Figures 10 and 14). Interestingly, Twareg child mortality in the 1960's was below that for the Fulbé who have a life-style not unlike the Twareg of the delta although the Fulani position of political and economic pre-eminence in the delta might be expected to be associated with an improved level of mortality. Before long, fully comparable data for all the Fulbé and the Rimaïbé will be available from the 1982 survey.

5b Fertility

Both cumulated numbers of children everborn and births in the preceding 12 months are available in the reports from the 1956-58 and 1960-61 surveys. Only the former includes data in a suitable form for the calculation of adjusted age specific fertility by the Brass P/F method. For the delta as a whole, the indicated total fertility rate was 6.5 (Table 23), a reasonably high level in comparison with the data from other Francophone countries in West Africa which were surveyed at about the same time (see INSEE/Ministère de la Coöpération, 1963, table 18). Between the ethnic groups, substantial fertility differentials were observed - highest amongst the Bambara, lowest amongst the Fulbé, with the Rimaïbé in between the two (Table 24). From the 1981 survey, Bambara total fertility was estimated at close to 8 compared to about 7 in 1956-58. Direct comparison of the raw data also support the idea that the fertility of the Bambara in the delta has risen in the period between the surveys. No data from the earliest two surveys are published on the fertility of the Twareg but a preliminary analysis of the 1981 birth history results indicates an almost unchanging level of fertility in the 15 years prior to the survey. If true, this would mean that Fulbé fertility in the late 1950's was lower than Twareg fertility in the late 1960's and early 1970's - an interesting finding which must await refutation or confirmation from the 1982 survey results.

The fertility data from the 1960-61 survey do not permit the calculation of age specific fertility by ethnic group although the data for all Mali (Table 25)

Figure 14. Child mortality in Mali 1940-1981

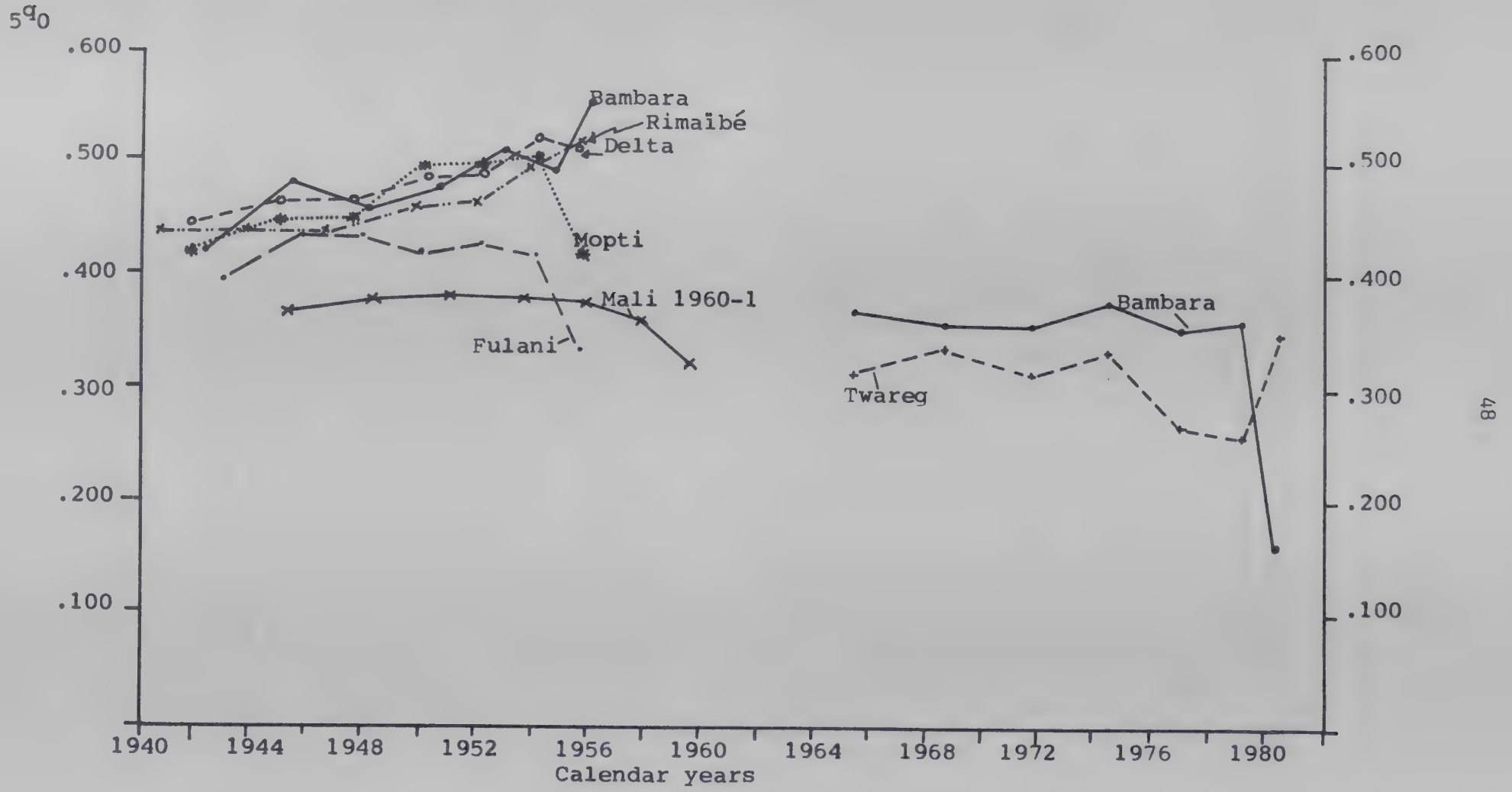


Table 23

CHILDREN EVERBORN AND BIRTHS LAST YEAR:
1956-58 SURVEY OF THE NIGER DELTA

AGE OF WOMEN	CHILDREN EVERBORN PER WOMAN P	BIRTHS LAST YEAR PER WOMAN f	P/F	ADJUSTED AGE SPECIFIC FERTILITY
15-19	0.50	.198	1.23	.187
20-24	1.80	.317	.95	.297
25-29	3.15	.259	.94	.244
30-34	4.31	.275	.91	.259
35-39	4.98	.207	.84	.195
40-44	5.36	.098	.81	.092
45-49	5.47	.032	.79	.030
		$5x\sum$ = 6.93		$5x\sum$ = 6.52

Source of data: Etude Démographique .. 1956-58, vol. 2, tables 3.18 and 3.25

Table 24

CHILDREN EVERBORN AND BIRTHS LAST YEAR BY ETHNIC GROUP

1956-58 SURVEY OF THE NIGER DELTA

AGE OF WOMEN	CHILDREN EVERBORN PER WOMAN P	BIRTHS LAST YEAR PER WOMAN f	P/F	ADJUSTED SPECIFIC FERTILITY
		BAMBARA		
15-19	.37	.171	1.15	.174
20-24	1.71	.325	.96	.331
25-29	3.31	.220	1.05	.224
30-34	4.57	.268	1.03	.273
35-39	5.95	.290	1.01	.295
40-44	6.11	.076	.92	.078
45-49	6.19	.026	.90	.027
		$5x\sum =$ 6.88		$5=\sum =$ 7.01
		FULANI-FULBE		
15-19	.52	.194	1.09	.164
20-24	1.55	.309	.83	.262
25-29	2.74	.224	.86	.190
30-34	3.77	.238	.86	.202
35-39	3.82	.142	.72	.121
40-44	4.55	.056	.79	.048
45-49	4.39	.013	.75	.011
		$5x\sum =$ 5.88		$5x\sum =$ 4.99
		FULANI-RIMAIBE		
15-19	.54	.225	1.07	.190
20-24	1.92	.380	.86	.322
25-29	3.07	.240	.82	.204
30-34	4.23	.221	.86	.187
35-39	5.04	.239	.82	.203
40-44	5.06	.087	.74	.074
45-49	5.23	.031	.74	.026
		$5x\sum =$ 7.11		$5x\sum =$ 6.03

Source of data: Etude Démographique... 1956, vol. 2, tables 3.19 and 3.28.

indicate that fertility in the delta was not far from the national average in the 1956-61 period.

5c Natural increase

The rather scanty data on natural increase by ethnic group are summarized on Table 26. In general, the heavy child mortality of the Bambara acts as a brake on their natural increase which nonetheless probably surpasses 3 per cent per annum for most of the Bambara population. In the richer and more typical arrondissement of Monnimpé, the crude birth rate calculated from the 1981 survey was 64 per thousand. The combination of slightly lower fertility and much lower child mortality amongst the Fulani produces an intermediate rate of natural increase of about 2.5 per cent. For the Twareg, the rate of natural increase is lower still with a level of fertility close to that for the Fulani but with perhaps slightly heavier child mortality. In terms of the modes of living therefore, it appears that the data from all three surveys broadly support the thesis of high rates of natural increase amongst settled farmers (the Bambara), with the lowest rates for the fully nomadic Twareg herders. The semi-nomadic Fulani fall between these two extremes both in terms of their rate of natural increase and their style of living.

Table 25

CHILDREN EVERBORN AND BIRTHS LAST YEAR: ALL MALI 1960-61

AGE OF WOMAN	CHILDREN EVERBORN PER WOMAN P	BIRTHS LAST YEAR PER WOMAN f	P/F	ADJUSTED AGE SPECIFIC FERTILITY
15-19	.55	.244	.79	.197
20-24	1.88	.350	.82	.282
25-29	3.25	.326	.82	.263
30-34	4.25	.272	.78	.219
35-39	5.01	.192	.79	.155
40-44	5.26	.087	.73	.070
45-49	5.35	.042	.71	.034
		$5x\sum = 7.56$		$5x\sum = 6.10$

Source of data: Enquete Démographique, 1960-61, p. 297 and p. 301.

Table 26

ESTIMATED NATURAL INCREASE RATES FOR SELECTED ETHNIC GROUPS 1956-81
(Rates per 1000)

		1956-58	1960-61	1981
MALI	CBR	NA	55	NA
	CDR	NA	30	NA
	R	NA	25	26
DELTA	CBR	55	NA	NA
	CDR	42	NA	NA
	R	13	NA	NA
FULBE	CBR	46	51	NA
	CDR	30	25	NA
	R	16	26	NA
RIMAIBE	CBR	54	51	NA
	CDR	33	25	NA
	R	21	26	NA
BAMBARA	CBR	54	63	57
	CDR	47	28	33
	R	7	35	24
TWAREG	CBR	NA	NA	49
	CDR	NA	NA	31
	R	NA	NA	18

Notes: CBR = crude birth rate; CDR = crude death rate;
R = rate of natural increase.

NA = data not available.

In the 1960-61 survey, Fulbé and Rimaïbé are not distinguished; the rates shown for both are the same.

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